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A MONTHLY POPULAR JOURNAL OF KNOWLEDGE

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THE OLD AND THE NEW SIDE BY SIDE IN JAPAN

The *torii* (sacred gateway) at the foot of Nantai-san, the holy peak above Lake Chuzenji, near Nikko, in Central Japan. Note the electric light, the telephone wire, and the English translation of the notice.

CONTENTS

	PAGE
EDITORIAL NOTES	113
THE ORIGIN OF CONTINENTS AND OCEANS — Prof. Alfred Wegener	114
THE GOLDEN BRANCH — Prof. R. S. Conway	118
THE AIRWAYS OF EUROPE — Major W. T. Blake	122
WHAT IS A CHEMICAL ELEMENT? — Dr. A. S. Russell	125
SOME RELIGIOUS BELIEFS AND SURVIVALS IN RURAL JAPAN — The Rev. Walter Weston	126
BIOLOGY IN SHAKESPEARE—I — Prof. D. Fraser Harris	132
REVIEWS OF BOOKS — New Revelations of Byron's Personality—The Evolution of the Earth—Books on Psychology, etc.	134
BOOKS RECEIVED	139
CORRESPONDENCE — Jupiter's Satellites—Racial Intermarriage—The Problem of Personality	140

JOHN MURRAY, 50A ALBEMARLE STREET, LONDON, W.1.

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DISCOVERY. A Monthly Popular Journal of Knowledge.

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Editorial Notes

IN this number Professor Alfred Wegener gives his first account in English of his theory of the origin of the continents and oceans. It has as yet received very little attention in this country on account of the difficulty of obtaining German publications during the war. Professor Wegener first put forward his theory in 1915, and republished it in 1920 under the title "Die Entstehung der Kontinente und Ozeane" ("The Origin of the Continents and Oceans"). We must leave the article to speak for itself, but we here quote the opinions of Professor Weiss, Professor of Botany at Manchester University, writing in the *Manchester Guardian* on March 16, that the new theory is one "of fundamental importance to the sciences of geography and geology, as well as of great interest to the biological sciences," and that "for the moment . . . *it* . . . constitutes a good working hypothesis, and the striking simplicity with which it allows many phenomena to be explained will greatly stimulate further inquiry."

* * * * *

One of the most welcome signs of approaching summer to Londoners and inhabitants of our large manufacturing towns is the less frequent visitation of fogs. For several years past it has been recognised how great is the part played by "chimneys" in these fogs. A problem, however, which has never hitherto been satisfactorily cleared up, is their very sudden development, particularly in London. How many times has one not woken, especially during the "season of mists and mellow fruitfulness," to a clear, blue sky, only to find oneself three or four hours later plunged into the gloom of a "pea-soup" fog? To how great an extent "the quantity of smoke emitted during this time in London is sufficient to account for the quantity of impurity found in the fog," i.e. for the density of the fog, is discussed by Dr. J. S. Owens in a paper in the latest report on *Atmospheric Pollution* [1] issued by the Meteorological Office, Air Ministry.

* * * * *

Dr. Owens made a microscopic examination of the fog air on November 5, 1920. A small jet of air impinged on the glass slide produced masses of particles of about 1/3,000th of an inch in diameter, the individual particles in these masses varying in size from 1/100,000th to 1/20,000th of an inch. "It is noteworthy," writes Dr. Owens, "how very small a quantity of impurity is sufficient to cause a dense fog, and this is doubtless due to the extremely small dimensions of the individual particles." The investigator calculates that, for the production of a really dense fog over London, about 190 tons of suspended matter are required. He estimates roughly that in London factory fires discharge eight or nine tons of smoke into the air every hour, and domestic fires about thirty-five tons, which in "over four hours of winter months would represent 176 tons." It should be noted that the average for the early morning hours in regard to factory smoke would be larger than that calculated from the complete working hours, owing to the fact that "fires are being made up and steam raised for the day's work." "It is not, therefore, remarkable," concludes Dr. Owens, "to find 190 tons hanging over London at 10 a.m. on a foggy morning, as the amount of smoke produced during the previous four hours is sufficient to account for it all."

[1] See under *Books Received.*

In years to come one of the names most honoured in connection with the reconstruction of post-war Europe will be that of Fridtjof Nansen. Dr. René Sand,[1] in a lecture on the Russian famine delivered at Brussels under the auspices of the Belgian Red Cross last February, said that " to look at Nansen is to look on the personification of goodness, energy, uprightness and generosity." Before he was thirty Nansen was appointed Professor of Zoology at Christiania University, and had been the first to cross Greenland, at a temperature of 58° F., dragging his own sledge. In the 'nineties he made the nearest approach to the North Pole that had till then been recorded.

* * * * *

Since the war he has worked with tireless energy, first as High Commissioner to the League of Nations for repatriation of the prisoners of war left in Russia and Siberia, rescuing 380,000 men ; later, and after the evacuation of Russia by the armies of Denikin and Wrangel in 1919 and 1920, as the League's High Commissioner for Russian refugees ; and is now acting as High Commissioner to the International Committee for Russian Relief. During the last few months he has been risking his life in the most plague-ridden portions of Russia. A century ago nations would have been inclined, under the circumstances, to leave Russia to make her own recovery. The efforts to help Russia that have been made by various nations in Europe and by the United States surely constitute a remarkable development in international consciousness and morality. With that development Nansen's name will always be associated.

* * * * *

That Sir Eric Geddes had a worthy predecessor in a high Roman official, Servæus Africanus, is evident from a letter in the *Oxyrhynchus Papyri* in the British Museum, to which a correspondent has called our attention. The Museum authorities describe it as follows :

Letter from Servæus Africanus, a high official . . . complaining of the useless multiplication of officials in the administration of the estates of the Treasury, in which many people " have devised for themselves various titles, such as administrators, secretaries, or superintendents, by which means they secure no advantage to the Treasury, but swallow up its surplus," and ordering that only one superintendent shall be appointed to each estate," with power to choose two, or at most three, other persons to assist him in his duties." (Dated 13th September, A.D. 288.)

[1] The lecture is published in *The World's Health* (the Monthly Review of the League of Red Cross Societies) for February 1922.

The Origin of Continents and Oceans

By Professor Alfred Wegener

Director of the German Oceanographical Survey

ANYONE who compares, on a globe, the opposite coasts of South America and Africa, cannot fail to be struck by the similar configuration of the two coast-lines. Not only does the great right-angled shoulder of the Brazilian coast find its exact counterpart in the African coast in the neighbourhood of the Cameroons, but the minor curves to the south of these great angles also correspond to one another, every protuberance on the one side fitting into a corresponding depression on the other. This observation has led to a new view of the nature of the earth's crust, according to which the continents in past ages have drifted horizontally over the surface of the earth, and are still in motion at the present time. According to this theory, known as the displacement theory, North and South America were, in Mesozoic [2] times, continuous with Europe and Africa. They then broke away and moved westwards in Tertiary times, the Andes being forced up by pressure on the forward edge of the drifting continent. Again, Antarctica, Australia, and India were formerly in immediate contact with South Africa, India then being the southern end of a long projection from the Asiatic Continent, which is now almost entirely crumpled up and forms the Himalayas. The theory asserts that the outermos trocky crust of the earth no longer envelops the whole globe, as it once may have done, but has shrunk up, in consequence of successive compressions into mountain folds. It is now represented by the continental shelves which are covered only by shallow seas. The bed of the deep seas is regarded as composed of the material of the underlying deeper layers of the earth, upon which the continental masses float. Fig. 1 shows the way in which the continents were formerly joined together, and gradually separated at successive epochs, according to this theory.

It will be evident that this theory conflicts with the former fundamental views of several sciences, and especially those of geology. For a proper judgment upon it an enormous mass of facts must be collected together from such sciences as geophysics, geology, palæontology, palæoclimatology, animal and plant geography, and geodesy. In the decade since the first publication of the theory, much progress has been made towards a wide review of the facts. The theory offers solutions for so many apparent insoluble problems, and so simplifies our views, that the interest of many kindred sciences has been aroused, as is

[2] For footnote see opposite page.

shown by the large and growing literature on the question.

It is impossible in so little space to discuss the evidence which confirms the theory; this evidence will be found in my book *Die Entstehung der Kontinente und Ozeane.*[1] It must suffice here to give a few of the main lines of proof, drawing examples from each of the sciences concerned.

In drawing up statistics of the distribution of levels over the land surface and sea bottom, geophysicists have found that these heights are grouped about two well-defined values, a land height of about 100 metres and a sea depth of about 4,700 metres. (Compare Fig. 2.) This law has been known for fifty years, so far without any explanation. If the heights and depths had arisen through elevation and depression of a single initial level, as geology has hitherto assumed, then we should expect statistics of level to show a grouping about a single mean value, as shown by the dotted curve in Fig. 2. Instead of this there is a grouping about two values. So we must suppose that there are two initial levels, on which the elevations and depressions have been superimposed; and this is only possible if these initial levels correspond to two different layers of the body of the earth. The continental masses consist of comparatively light material (such as granite and gneiss) extending downward, according to Hayford and Helmert, to a depth of 100 kilometres. The deep sea bottom is apparently composed of heavier material (such as basalt), in which the continents float like great ice-floes in water. The results of measurements of gravity, and of magnetic and seismic investigations, are in agreement with this conception, and the results of dredging do not contradict it.

Geology provides a very searching test of our supposition that the Atlantic is really an enormously widened rift. If this is the case, the mountain folds and other geological structures which existed before the separation must correspond when we bring the continents together again and reconstruct their original relative position, just as the lines of a torn drawing would correspond if the pieces were placed in juxtaposition. This is actually the case; the Permian folds of the Cape mountains fit exactly to the Sierras of Buenos Aires, which, according to the latest work of the Argentine geologists, are of the same age and have a completely similar structure. The distance of these mountains from the Cameroons on the one side, and from Cape San Roque on the other, is the same, so that they fit each other exactly in the reconstruction. The direction of folding in the great gneiss plateau of Brazil also corresponds with that in the opposite regions of Africa. In Europe there are three ancient mountain chains which arose in the Silurian, Devonian, and Carboniferous epochs, and these mountain chains are so placed in North America that they appear in the reconstruction as undoubted continuations of the European system. The terminal moraines of the Great Ice Age also appear now as a continuous system. The most striking fact is not the existence of the same features across the Atlantic, but their situation at places which correspond exactly. For example, if the Sierras of Buenos Aires, which are now more than 6,000 kilometres distant from the Cape mountains, lay only a few hundred

[1] Not yet translated into English. Published by Vieweg & Son, Braunschweig. 2nd Edition, 1920.

[2] The geological terms in general use to indicate long periods of past time are tabulated below. As matters of interest, examples of the rocks formed during the period and prominent life-forms of the period are included in the table. In the fifth column are given estimates, necessarily rough and speculative, taken from Dr. Wegener's book, of the number of years between the beginning of the period and the present day.

ERAS AND PERIODS OF GEOLOGICAL TIME

Era.	Period.	Examples of Rocks in the British Isles.	Prominent Life-forms.	Estimate of Years since Period began.
Quaternary	Recent and Pleistocene	River gravels	Man and present-day animals appear	About 1 million
Tertiary	Pliocene	Gravels of E. Anglia	—	2½ million
	Miocene	—	—	6 million
	Oligocene	Clays of Hampshire Basin	—	8 million
	Eocene	Clays of London Basin	Mammals become common and varied in type	10 million
Mesozoic or Secondary	Cretaceous	Chalk of Downs	Birds appear	—
	Jurassic	Sandstones of N. Yorkshire	Reptilian life varied and profuse	—
	Triassic	Salt deposits of Cheshire	Mammals appear	50 million
Palæozoic	Permian	Red sandstones of Nottinghamshire	Reptiles appear	—
	Carboniferous	Coal-seams of British coal-measures	Amphibia appear	—
	Devonian	Limestones of Ilfracombe	Fishes common	—
	Silurian	Limestones of the Welsh Border	Fishes appear	—
	Ordovician	Shales of Central Wales	—	—
	Cambrian	Shales of N. Wales	All classes of invertebrate animals present	500 million
—	Pre-Cambrian	—	—	Greater than 500 million
	Archæan	Gneisses of Highlands of Scotland	No undoubted traces of life	

kilometres farther to the north or south, the features would not fit on bringing the continents together.

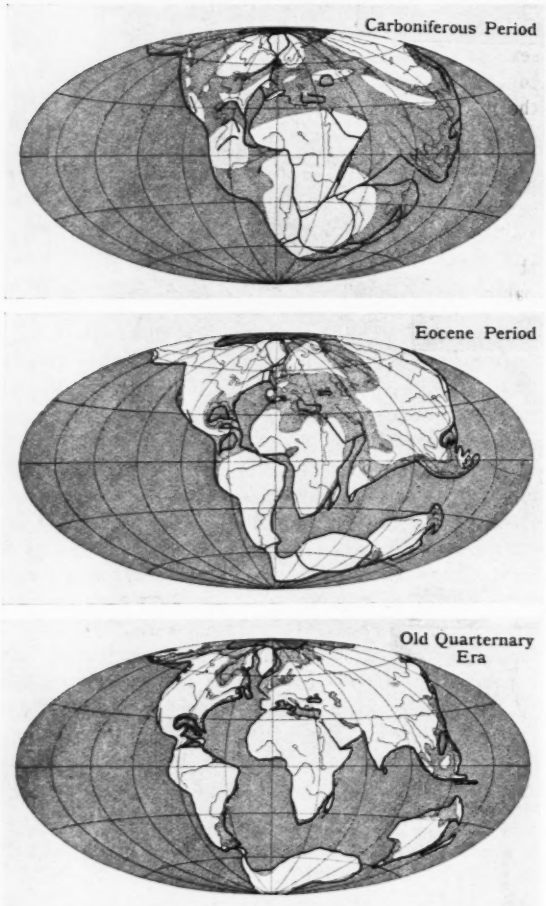

FIG. 1.—THE WORLD IN THE CARBONIFEROUS AND EOCENE PERIODS AND OLD QUATERNARY ERA ACCORDING TO THE DISPLACEMENT THEORY.

White denotes land, dots shallow water, cross-hatching deep sea.

Actually, they do fit, and the correctness of our theory becomes the more probable as such coincidences multiply themselves.

The results of palæontology have led to the assumption of the existence of former land bridges, between continents now separated by deep sea, over which an unrestricted interchange of fauna and flora took place. That such an interchange has at one time taken place is shown by the identity of fossil forms and the relationship of living forms. Now, these land bridges have been assumed exactly in those places where the theory put forward here indicates a former direct connection, as, for instance, between Brazil and Africa, between North America and Europe, between Madagascar and India, and in general between all the southern continents such as South America, South Africa, Madagascar, India, Australia, and Antarctica. It has hitherto been assumed that these land bridges were afterwards submerged, and now constitute the bottom of the deep sea. This conception is physically untenable, for the continents are floating in equilibrium on a heavier underlying layer, and could not sink by so great an amount as five kilometres unless they were loaded down by superincumbent layers to at least an equal height. In addition, when all the necessary connecting land masses are reconstructed it is impossible to find room for the displaced masses of water. Further, the continents now lie so far away from each other that, even if a former land connection existed, it would not account for the identity of their former fauna and flora. These difficulties disappear naturally when the displacement theory is assumed.

From the mass of information to be derived from the geographical distribution of animals and plants we shall only choose a single striking example: the threefold character of the Australian fauna. The most ancient group of animals,[1] which is now found principally in the south-west, shows relationships with India, Ceylon, Madagascar, and South Africa. The second group, to which the characteristic marsupials and monotremes belong, contains, in distinction to the former class, only such animals as can resist cold (mammals, fresh-

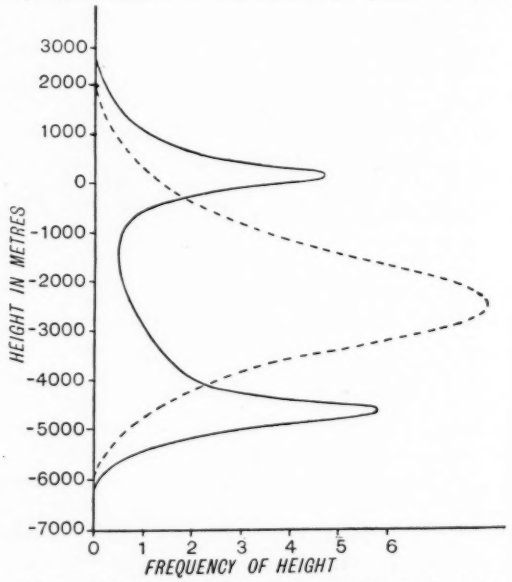

FIG. 2.—THE TWO MAXIMA, AT 100 METRES HIGH AND 4,700 METRES DEEP.

water fishes, but not reptiles or earthworms). This group has penetrated into the eastern Sunda Archi-

[1] The so-called "Gondwanic" group.

pelago owing to the present proximity of Australia to that region.[1] This class has its nearest relationships in South America, now separated from it by a whole quadrant of the earth. The third group, finally, is the fauna of the eastern Sunda islands, which is found in New Guinea and which has established itself in north-eastern Australia. This relationship, formerly so puzzling, is completely explained by the displacement theory. As Fig. 1 shows, Australia, up to the beginning of Jurassic times, was connected in the west with India and Ceylon, and through them with Madagascar and South Africa. This explains the ancient "Gondwanic" group. After breaking away from India, it was still connected through Antarctica with South America, perhaps as late as Eocene times, and this connection gave rise to the second group. Comparatively recently Australia drifted into collision with the Sunda islands, with the consequence that an interchange of flora and fauna took place.

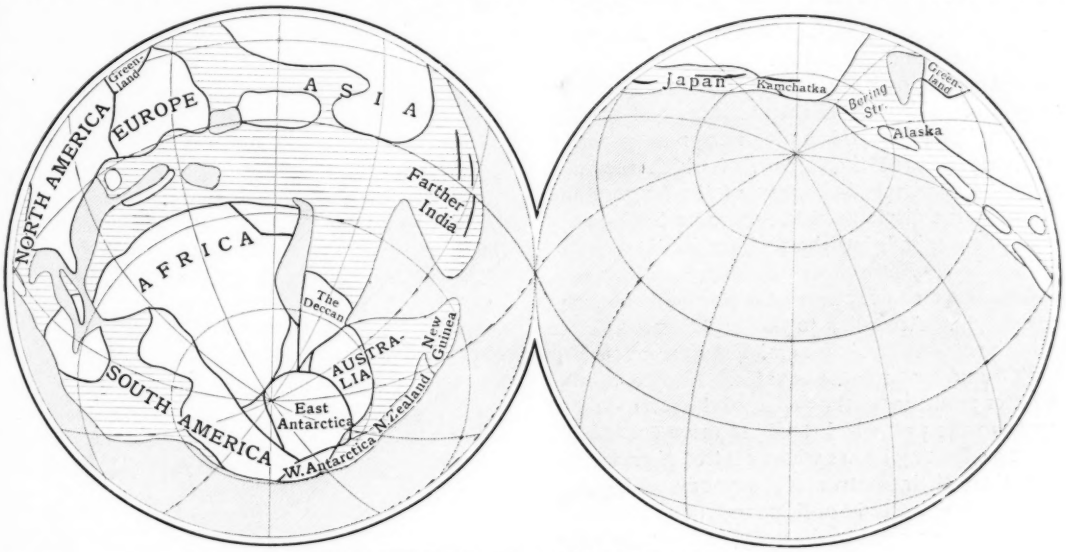

FIG. 3.—THE WORLD IN THE CARBONIFEROUS PERIOD, SHOWING THE POLES.
Diagonal lines denote deep sea; horizontal lines shallow water; unshaded portions land.

In seeking an explanation of former climatic conditions, geologists have hitherto been averse to the assumption of large movements of the earth's poles with reference to the land. However, the idea that it is necessary to assume a considerable movement of the poles in early Tertiary times has recently been gaining more and more ground. It is impossible to overlook the fact that all former attempts to map out the position of the poles throughout the earth's history come to grief on one obstacle, namely, the Permo-Carboniferous ice age in the southern hemisphere. Traces of inland ice at this period are found in Brazil, the Argentine, the Falkland Islands, Togo Island, the Congo, South Africa, India, Western, Central and Eastern Australia. These traces are to-day so widely separated from each other that they cover nearly a complete hemisphere, and even if the pole be placed in the most favourable position, the traces of ice most distant from it would be in a geographical latitude of only 15° and so be in the tropics. On the other hand, we do not know of any certain traces of ice in this epoch in the other hemisphere. This fact has so far constituted a hopeless riddle, and it is no exaggeration to say that it has completely crippled the development of palæoclimatology. The displacement theory affords a striking solution of the riddle; at that period all these continents were grouped concentrically around South Africa, and we thus obtain a connected ice cap of no greater area than that of the quaternary ice-age of America and Europe.

Similar, if less striking, simplifications appear when the position of the pole in other geological periods is determined by aid of the displacement theory, and it is not too much to say that this theory makes it possible, for the first time, to determine the former positions of the pole from fossil evidences of climate in a manner that is satisfactory.

Finally, the displacement theory may be tested by astronomical determinations of latitude and longitude. It is natural to suppose that the movements are still taking place, and the available estimations of geological time, in spite of their uncertainty, allow us to make an

[1] The dividing line, which defines the extent to which this group has penetrated, has been drawn by Wallace between the islands of Bale and Lombok.

approximate estimate of the yearly movement to be expected. It would appear that in many places the velocity of displacement must be too small to be measurable astronomically in a reasonable time. However, in three or four places it should be possible to establish the movement by measurements repeated after a ten years' interval. In the case of the movement of Greenland relatively to Europe, I. P. Koch (the cartographer of the Danish Expedition of 1906–8) has made a comparison between the observations of this expedition and those of the second German North Polar expedition of 1870 and still older observations of Sabine in 1823. He has succeeded in deducing evidence that the distance of Greenland from Europe has noticeably increased in the interval, by an amount exceeding considerably possible errors of observation. There is evidence of a movement of about 15 metres a year which is in complete agreement with that to be expected from the displacement theory.

We will conclude with this the series of examples from our chain of evidence. If the standpoint of the displacement theory be taken up, numerous problems immediately present themselves, of which the most important is perhaps the nature of the forces which give rise to the displacements. Here no final conclusion can be reached, but the problem has been so far examined by the theoretical physicists and geophysicists as to leave no doubt as to the possibility of such a force existing. According to the displacement theory, the continents display, in general, a movement towards the West and towards the equator. Köppen ascribes this latter tendency to the action of the force directed away from the pole which tends to drive towards the equator all floating bodies whose centres of gravity are higher than their centres of buoyancy. This force has been calculated to be of the magnitude of one three-millionth of the weight of the body, and so to be rather more than the tidal force. It may be shown that this force is sufficiently great to pull the continental masses through the underlying layers with the necessary slowness, even if these layers are as rigid as steel at ordinary temperatures. On the other hand, it seems questionable whether this force can explain the great Tertiary mountain folds, which extend from the Himalayas through the Alps to the Atlas Mountains, along the line of the equator in those times. It is not impossible that at that period, and perhaps in the earlier Carboniferous period, still other forces existed in addition to the normal force directed from the pole, owing to rapid displacements of the pole and the consequent readjustment of the figure of the earth to the new polar axis, these forces being perhaps twenty to a hundred times as great. This would give a possible explanation of the fact that this equatorial mountain folding is limited to these periods.

Just as the movement from the poles manifests itself principally in mountain folds along the equator, so also the westward movement of the continents is evidenced by many striking features of the earth's face which has hitherto been completely unexplained. We have already instanced the frontal resistance which the American continental masses experience in moving through the ancient and deeply cooled bottom of the Pacific, a resistance which has led to the throwing up of the gigantic mountain chain of the Andes. Since this frontal resistance must have a much greater influence for small masses than for large, these small masses will be left behind in the general westward movement. Thence arises the great sweep of the Antilles, left far to the east by America, and the great bend of the so-called southern Antilles between Tierra del Fuego and West Antarctica. Thence also comes the partial separation of the eastern edge of Asia in the form of chains of islands, and the separation, long ago completed, of the former Australian coastal chain which now forms New Zealand. By the same movement Ceylon has been broken away from India, and we see evidence of it also in the bending of all the ends of continents towards the east, such as the southern end of Greenland, of Tierra del Fuego and the northern end of Graham Land. Schweydar has suggested an origin for the force driving the continents westward which he believes to be due to the procession of the earth's axis, but the whole question of the origin of the forces is so much in a state of flux that it is impossible at present to reach any final conclusions.

New Light on Old Authors

IV. THE GOLDEN BRANCH

By R. S. Conway, Litt.D., F.B.A.

Hulme Professor of Latin in the University of Manchester

MOST of us who have any interest in primitive religion and folk-lore know the name of Sir James Frazer's great book, *The Golden Bough.* But it is quite likely that a large number of those who have from time to time quarried in its wonderful mines of learning, or strayed in its charming avenues of fancy, would find it hard to say just why he gave it that name. And even if they did remember something about the Vegetable-Spirit, they might still find it difficult to know how it was connected with Vergil's story of the descent of Æneas into the Underworld, and his having to pluck a golden branch from the midst of a dark forest in order to traverse that world unscathed. And in truth their difficulty would be pardonable,

since it has worn more than one look to the distinguished author himself; for latterly[1] he seems to have modified the particular theory, which he had in part taken over from some ancient mythologist, connecting Vergil's golden branch with the weird custom of the runaway priest or "king" (*rex nemorensis*) of Diana's grove at Nemi. This person, always a runaway slave, became "King of the Forest" by slaying his predecessor, and remained king until he failed to defend himself against some new aspirant:

> "The priest who slew the slayer
> And shall himself be slain"—

so Macaulay described him.

Instead of regarding the King of the Forest as the Vegetable-God incarnate, who has to be sacrificed[2] as soon as another candidate for godship who can boast a larger portion of Vegetable-Spirit (i.e. of physical strength) appears in the neighbourhood, Sir James later on counted him as a survival of the religious side of the kingship of some tribe, whose name is not recorded, but who, for some reason or other, dumped their King-Spiritual into the somewhat depressing surroundings of Diana's temple at Nemi, just twenty-five miles from Rome, with no one to see that the rules of his sacred game were kept, and went off to some region, also not recorded, with their King-Secular to conduct their public business for them without having to worry himself any further about oaken boughs and godships and murderous rivals.

The result is that poor Æneas was left rather in a mist. We know that he plucked a golden branch, that he carried it with him to the Underworld, and that he fixed it on the door of the infernal palace of Queen Proserpine, the bride of "dusky Dis." But why Æneas did all this Sir James Frazer does not seem to tell us so confidently as before; yet he would still like us to think of the branch as embodying the life of the Oak-tree—though it was a holm-oak (*ilex*), not an oak (*quercus*), on which Æneas found it; and though it is likened by Vergil to a mistletoe "alien to the tree on which it is growing." For all that, most of us will gladly believe all that Sir James can tell us about oaks—at least, short of identifying the *quercus* and the *ilex*; but all the oaks of the forest bring us no nearer to Charon or Proserpine. On the contrary, as Sir James (following Dr. A. B. Cook[3] and Dr Warde Fowler[4]) most justly insists, they point us up to Jupiter, the god of heaven.

Nor can the latest and most learned of commentators on the Sixth Book of the *Æneid*, the great Berlin scholar, Eduard Norden, find a word of explanation to offer, beyond the conjecture that Vergil must be following some piece of folk-lore unknown[5] to us. Is there, I wonder, any other incident in the whole range of ancient story which is, in itself, so fascinating and romantic, so arresting even to a child's imagination, about which so absolutely nothing is yet known?

After this the reader will not expect in this article any complete theory of Vergil's motive for devising the incident or for giving it so central a position in his story. But there is, I believe, one avenue of interpretation which has not been sought. And yet to most of us it is far the most important of all lines for search, even though it may not be very satisfying to those who study Folk-lore for its own high scientific sake. I mean the question whether in Vergil's own poem there are any indications of the kind of ideas with which this picturesque detail was linked in his mind. Whether, in other words, Vergil had, even in part or at times, any thought of an allegorical meaning beyond the plain value of the Branch as helping the movement of the story; and, if so, what that allegorical notion may have been.

No one can be confident that Vergil would have been willing to answer such questions if we had put them to him. He might have told us that we could read the story for ourselves; that we were welcome to profit by anything we found in it; but that he could not put his story into prose, not even the prose of Philosophy, because that would destroy it. He might even ask us in our turn whether we did not like the Golden Branch where Æneas plucked it, and where Æneas left it; whether we did not think that it was in place in either case; whether we thought there could have been such a story without it. All this, Master Vergil, as Roger Ascham no doubt called him, might fairly ask us, and we could only answer each question in one way.

Nevertheless, readers of poetry, though they may not want the poetry altered by a single scene or word, have after all a right to try and translate it into their own humble prose; and, indeed, if they do not attempt such a translation, they can never be quite sure that they have reached the meaning which it really carries. A poet may and must put his suggestions into pictures. But his readers will always ask what the picture means. And if we find that a

[1] See, for instance, his *Lectures on the Early History of the Kingship* (1905), p. 25, where he writes of a statement of Servius: "I greatly regret that in former editions I missed its significance entirely." Or the preface to *Balder the Beautiful* (1913), where he speaks of the runaway priest of Nemi as a "puppet" which has served his purpose and may now be put into the lumber-room.

[2] See *Golden Bough*, Edition 1 (1890), c. 3.

[3] *Zeus, Jupiter, and the Oak*, Cambridge, 1920.

[4] *Roman Essays and Interpretations*, Oxford, 1919.

[5] Reasons which have nothing to do with Nemi or its priest were suggested by Sir James Frazer in the second edition of his *Golden Bough*, iii. 405, footnote 5.

particular image in any one poet is closely associated with a certain train of thought, then at least we may be sure that there is nothing in the image which will be inconsistent with that thought; and we may guess, though we cannot be sure, that that thought itself is some part of what the image was intended to suggest.

So our enquiry here will not be a matter of folk-lore; not what the ancient Italian peasants believed about the mistletoe, nor why they believed it, interesting as such questions may be, but rather this: what ideas does Vergil connect most closely with this golden image? It was essential to the purpose of Æneas, that much everyone sees. It carried him through the Underworld in safety; it kept him living in a region where all else was dead; it reduced the "grim ferryman," Charon, to obedience; it made even the ruling powers of the dead world complaisant. Is it not, then, well to ask what else there was essential to the errand of Æneas? What commands are given him? What kind of motive is enjoined upon him? What kind of a meeting does he seek, or find? What kind of a revelation crowns his journey? All this contributes to the question to which, from another and more general point of view, I have sought an answer in a lecture recently published on *The Philosophy of Vergil*[1]; namely, what was the central and most characteristic part of Vergil's view of life?

But we must not stray yet from the Golden Branch and its immediate surroundings. Into what class of persons was Æneas admitted by the privilege of gathering it? The Sibyl tells us, "those few whom just Heaven has loved, themselves of divine birth," who have been allowed to enter and leave the Underworld alive. Clearly, therefore, there is something essentially divine about the Branch, some element of majesty superior to ordinary mortal limitations. But can we further discover in what this divine majesty consists?

What is Æneas sent to do? Nothing in itself transcendent, not to rescue a bride, or to make any change in the gloomy region he enters. No, he is only going to see his father. True, he is to receive from him a revelation. But the revelation has largely been given already. He knows already from other sources that he is to found a new nation, and a great nation; and he has actually reached Italy, which is to be that nation's home. What he has to learn is mainly the importance to mankind of the work which that nation will do; in particular the restoration of the Golden Age, to be accomplished by the great Augustus. For in his day, peace was to return to an afflicted world; justice, free intercourse, harmony and merciful government was to be everywhere established. That is the climax of the revelation. But at the moment when Æneas is seeking the Branch he has in his mind nothing but the longing to see his father; and when he arrives, his father greets him knowing nothing of the Branch, but only seeing the cause of his son's triumph over the powers of darkness in that son's affection. So that, whereas the Sibyl might have said, "It is the Golden Branch that has brought you here," Anchises does actually say, "It is your own *pietas*, your own devoted affection, which I knew would not disappoint me."

This double description of the power which brought Æneas on his way is most characteristic of Vergil. First, the supernatural image linked with old folk-lore in the poet's mind; and, secondly, the natural motive which Anchises—who, after all, saw things from a loftier point of view than the Sibyl—recognises as the moving cause of the journey.[2]

But again, how did Æneas come to find the Branch? Only because he delayed his departure from the upper world in order to render the last honour he could to a friend who had been suddenly cut off; and to render it by hard work, felling trunks of trees to build a lofty pyre, and penetrating into the heart of the wood to seek them. The Golden Branch, then, would seem to grow somewhere beside the path which men tread who do honour to their friends at some cost to themselves.

Again, when does Æneas find it? The discovery is granted in direct answer to a prayer. That, of course, is not strange, seeing what divine power the Branch has when once discovered. Yet it adds a point to its character. It is divine, we knew. But we know now that it is given to those—and presumably only to those—who approach its divine creators and sponsors in the attitude of reverence and of what in Christian phraseology might be called faith.

Yet again, how are the eyes of Æneas actually guided to the Branch? By two twin doves whom he recognises as sacred to his mother, Venus; they fly before him into the forest just far enough to lead him on without passing out of his sight; and they finally settle on the tree "whence through the boughs flashes the strange, half-breathing gleam of gold."

Now in the *Æneid* Venus is a distinctly mixed character. She often does a great deal of harm. But so far as Æneas is concerned she is always trying—in her own too clever ways—to do what a mother should; and in his relation to her there is never anything but reverence and affection, which indeed appear here in

[1] The editor of the *John Ryland's Library Bulletin* kindly allows me to offer to the readers of DISCOVERY some account of the investigation which is traced more fully in the pages of that journal (vol. vi, p. 384).

[2] Other examples of this habit of giving double causes, natural and supernatural, side by side are collected in the article just referred to, pp. 389 ff.

his words at the point when he sees the doves. And the doves themselves are surely connected with the better side of the activities of Venus. They suggest not the storm and stress of passion, but the calm of steady and settled affection, the light and warmth of home.

My point need not be, surely, laboured further. If the Golden Branch was not connected in Vergil's mind with the strength of natural affection, with the ties between father and son, between son and mother, between friend and friend, then it was at least a most happy accident that, in his story, linked such motives so closely to so beautiful an image. And in great poets accidents rarely happen.

Without some specific declaration on the part of the poet himself, such as good John Bunyan loved to prefix, and infix, and superfix to every part of his allegories, or such as Spenser and Milton did not always disdain to add to the stately figures of their own creation—without some such confession on the poet's part we are, of course, bound to limit our conjectures with a prudent "perhaps." Yet one thing at least about Vergil is not a "perhaps," but quite certain and demonstrable; namely, that to him the central interest of the world was in human affection. In this lay what for Vergil was the supreme paradox of life; the supreme example which proved the need of stating things by antithesis, of always seeing two sides to every human event.

In the paper to which I have referred, evidence is given at some length of Vergil's habit of double sympathy; of the way, for instance, in which he cannot picture the bees being caught and killed by the swallows without indicating in one and the same[1] line his sympathy both with the hapless bees and with the hungry young swallows, whom the bees are slain to feed. This is a tempting theme which I must not develop further here. Every thoughtful reader of Vergil will be able to recall other examples; the greatest is in the tragedy of Dido.

There was only one thing to Vergil that really mattered in this world, and that was the affection of human beings, their affection first for their own human kind, secondly for their fellow-creatures, and, thirdly, for the power which we call Nature, who to Vergil was a being not less throbbing with life and affection, not less bountiful of love to men, than any human mother to her child. Need I attempt to illustrate this side of Vergil's personality? Through all the ages it is this which has endeared him to thousands of unknown readers who, through the veil of mist raised by the strangeness of his tongue and the distance of his times from their own, have felt the central, inner glow of his human affection, the throbbing pulse of that great heart. Think of his picture in the *Georgics* of the farmer at home with his children hanging round his kisses; think of the delight with which he notes the ways of animals small and great, but especially the small ones—birds and insects and little creatures of the soil; how more than once[2] he bursts into an enthusiastic avowal of gratitude to the beneficent power that strews men's path with blessings. But perhaps, since the *Æneid* is less often read as a whole, we are less conscious how often the same note sounds in that poem. Think of the line in the Sixth Book where, among those who receive the highest honour in Elysium, the snow-white garland, the last class consists of those who, "by their good deeds, have made two or three folk remember them" (*quique sui memores aliquos fecere merendo*). With what gentle sympathy does Vergil sketch the figure of every aged man—Anchises, Evander, Latinus—and of every youth—Pallas and Lausus, Nisus and Euryalus? Or when Galæsus is slain at the outbreak of the fighting in Book VII, failing in his efforts to pacify his countrymen, how many readers have noted how his flocks and herds at home and all the people of his farm are brought into the picture to represent the mourning for their master? Or think of the feeling shown for Silvia's pet stag, whose accidental wounding by Ascanius is the signal for the outbreak of war. This incident is actually censured by a wise modern critic as merely pretty and Alexandrine, quite beneath the dignity of the Epic!

But I need not prolong the enumeration. Let me ask the reader only to realise the tragic paradox which Vergil found beneath this lovingkindness of the world: the fact that our human affection is the source both of the only joys worth counting joys, and of the only sorrows worth counting sorrows. Every one of the troubles of the *Æneid*, every one of its tragedies, springs ultimately from this. The tragedy of Dido, first from the misguided affections[3] of Juno and Venus, and then from her own; the tragedy of Juturna from her love for her brother; the war in Latium from Silvia's affection for her stag and her followers' affection for Silvia; the second outbreak from Turnus' love for Lavinia and his followers' devotion to Turnus; the tragedies of Brutus and Torquatus, briefly mentioned in the vision of Anchises; the tragedy of Marcellus, pictured at the end of the same revelation—the essence of all these lies in the affection of some men or women, ill guided or ill governed, or crossed by physical calamity. With the solitary exception of Drances (who plays but a small part), there is no such

[1] *Georgics*, iv. 17.

[2] *Georgics*, ii. 323 ff.; 433, 516.

[3] These were of a political, nationalist type, but affections none the less; see a fuller discussion of this in my *New Studies of a Great Inheritance*, p. 161.

motive in the whole of the *Æneid* as that from which the *Iliad* starts, the high-handed selfishness of one primitive chieftain compensating himself by robbing another. Compare and contrast with this the crowning scene of the *Æneid* in which the conquered Turnus might have been spared but for what, to the ancient mind, was his inhuman cruelty to Pallas and his father, of which he still wore the trophy in the baldric of Pallas girt upon his own shoulder. Such an offender must not survive into the new era; the violence of Turnus would have continued to trample on the sacred laws of humanity; yet even Turnus Vergil could not doom without a note of pity; in the last words of the whole epic the soul of Turnus passes "indignant to the shades."[1]

Now it was in this common source of human sorrow and human joy that Vergil found the supreme paradox which for him wrapped the world in mystery. Yet, strange and mysterious as the contradiction was, he held it to be the key of life.

Here, I believe, we have reached the centre of Vergil's thought. All the sorrow and all the joy of the universe seemed to him to spring from one root, and he accepts, nay, he welcomes, them both. There could be no human affection, so Vergil saw, unless it were such as to make its possessors capable, and capable in equal degrees, of the most exquisite suffering and of the most exquisite joy. This to him is the fundamental fact of the universe—that all pain and all joy is to be measured simply in terms of human love. And if you ask him his last word upon this mystery, the mystery on which he has pondered year after year, viewing it from both sides, through all his study of life, he will tell you that the Golden Branch is always found in the shadows of the forest, when it is sought in fulfilment of duty. And while others may turn away from the sight or thought of those shadows in mere dread or disbelief, Vergil will bid us, like his hero, pluck the Golden Branch eagerly and trust it gratefully, to bring us through even darker shadows out into the light beyond; to trust that somewhere, somehow, Death itself is overcome by the power and persistence of Love.

The best translation of Vergil is the verse-rendering of the *Æneid* and now of the *Georgics*, by Mr. James Rhoades. (Longmans, Green & Co.)

[1] This point is developed more fully in *The Messianic Eclogue of Vergil*, p. 46.

NOTICE

THE June number of DISCOVERY will contain, amongst others, articles on *Unemployment and Taxation*, by Professor Douglas Knoop; *Some Recent Work on the Ductless Glands*, by Dr. L. T. Hogben; *Fertility Rites in Modern Egypt*, by Miss W. S. Blackman; and a concluding instalment of Professor D. Fraser Harris's paper on *Biology in Shakespeare*.

The Airways of Europe

By Major W. T. Blake

EUROPE is rapidly being covered by a network of highly organised airways. Already it is possible to fly on regular services between the capitals of the greater number of European countries, and by the summer, services now being arranged will be operating to most of the large towns west of Russia.

At the present time France controls by far the largest number and the largest mileage of airways. The generous subsidy granted by the French Government partly accounts for this, but more important still is the fact that our Allies are keenly alive to the commercial possibilities of aerial transport. At the present moment Paris is the most important air-centre of the whole world, though in respect of organisation the Paris terminal aerodrome at Le Bourget cannot compare with London's terminus at Croydon, which is the largest and best-equipped commercial air station in existence. By next summer it is highly probable that Croydon aerodrome will accommodate as great a volume of traffic as that now passing through Le Bourget. When the Allied restrictions are removed, Germany will make a big bid for the aerial traffic of the world, and plans have already been made for the extension of the many services which are already running with great regularity throughout the whole part of the German Republic.

From Paris services run (*a*) to London, (*b*) to Brussels, Rotterdam and Amsterdam, (*c*) to Strassbourg, Prague, and Warsaw, (*d*) to Havre, (*e*) to Lucerne; and a service via Strassbourg and Prague to Vienna, Bucharest, and Constantinople will be opened shortly. Other French services proceed from Toulouse via Barcelona, Alicante, and Malaga to Rabat and Casa Blanca in Morocco, whilst a service from Marseilles to Genoa is being organised. There are also several smaller services which operate between various towns. By means of this network of air lines the traveller can proceed from Paris to London in about three hours, instead of the eight hours required by boat and train; to Warsaw in less than twelve hours for the complete journey, as against nearly fifty by train; or by taking the train to Toulouse and thence using the airway to Morocco, can cover the journey to Casa Blanca inside two days, as against nearly four days' travelling by rail and steamer. There is also a probability that an airship service from Marseilles to Algiers will shortly be put into operation.

After France, Holland controls the largest mileage of airways, the K.L.M. service operating from Amsterdam to Rotterdam and London in one direction, and to Hamburg, Bremen, and Copenhagen to the

north. A service also connects Amsterdam, Brussels, and Paris. It is probable that these lines will be extended this year.

Germany, despite the inter-allied restriction on the manufacture of aircraft and the exploitation of airways, is rapidly going ahead with aerial transport. Practically all Western and Eastern Germany is linked by a network of airways over which aircraft ply with great frequency and regularity, carrying mails, passengers, and goods. To encourage the use of air mails, the German Government has reduced the postage fees with such success that aircraft carry large quantities of letters on every flight. Services are being organised to link up Germany with Esthonia and Latvia, and there is every probability of the large German firms of Junkers and Sablatnig being moved from Germany to one or other of these Baltic Republics in order that they may carry out their activities without restrictions. It is possible to fly from London to Berlin within a day, taking the K.L.M. service from London to Bremen, and thence continuing to Berlin by the Lloyd-Sablatnig airway. The German Zeppelin firm is also responsible for the coming airship service from Spain to South America.

Portugal is now coming into the world of civil aviation with services from Lisbon to Paris via Valladolid and Bordeaux and other lines, from Lisbon to Corunna, and from Lisbon to Madrid, but few particulars of these new services are available other than the fact that the capital of the company concerned is 2,000,000 escudos.

Britain comes a poor fourth in the development of the airways if one considers mileage only. At present one route alone is being exploited by British companies—that from London to Paris, over which two companies, the Instone Air Line and the Handley-Page Transport, operate regularly.[1] The recent granting of a subsidy for aerial transport has encouraged other firms to investigate the question of aerial transport, and services will shortly operate to Brussels and probably to Amsterdam as well as to Paris. It is a pity that Britain is so far behind other countries in the development of her airways, since her organisation for aerial transport is the best in the world; her machines are unbeaten by those of any other country; and the qualities of British pilots are so well realised that several foreign companies employ them in preference to pilots from their own nation.

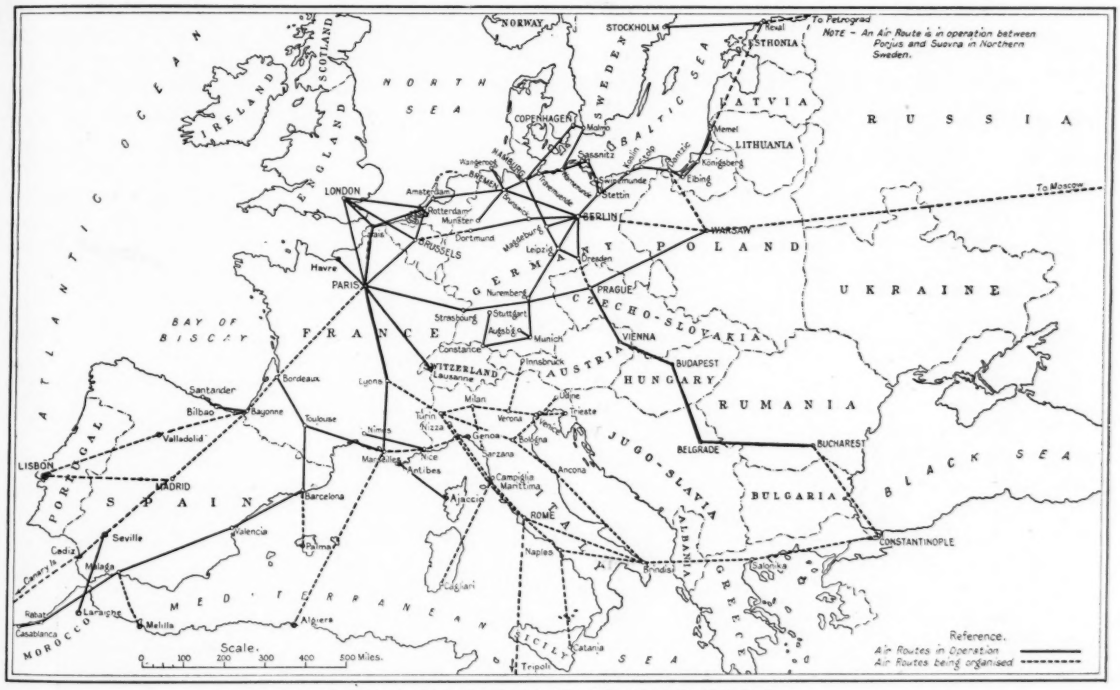

FIG. 1.—A MAP SHOWING THE EUROPEAN AIRWAYS.

Many people have been deterred from travelling on the airways because they believe that air travel is unreliable, if not dangerous, uncomfortable, and expensive. With regard to the question of unreliability and

[1] Daimler Hire Ltd. has also commenced operations on the London–Paris service since this article was first written.

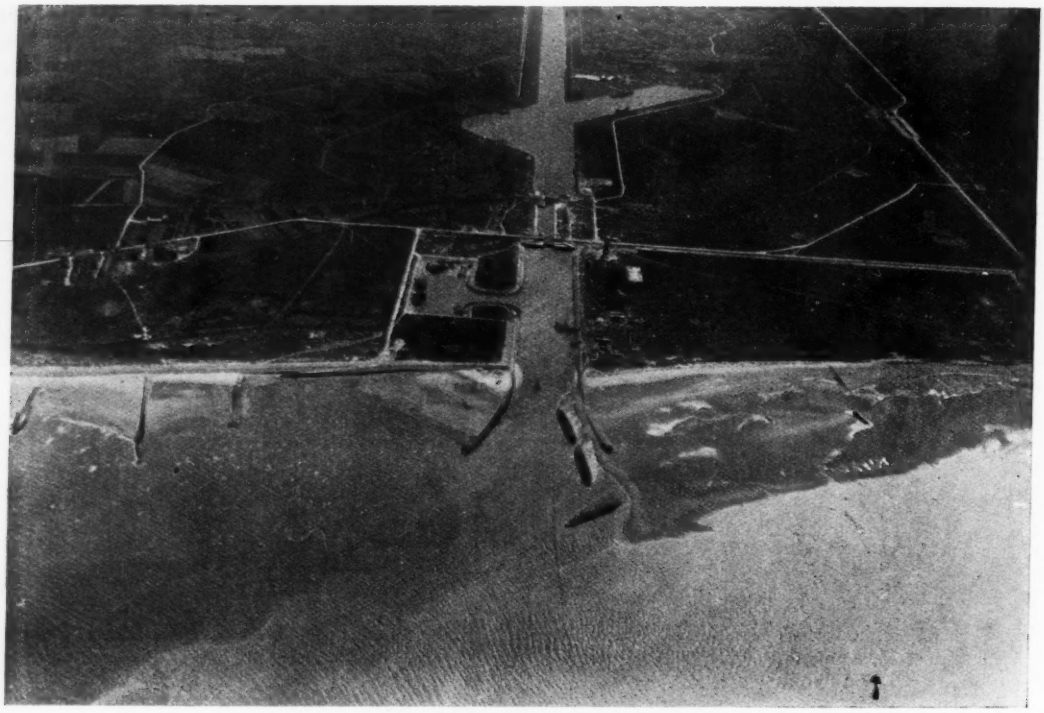

FIG. 2.—ZEEBRUGGE AND THE FAMOUS BLOCK SHIPS.
Passed over on the London-Amsterdam route.

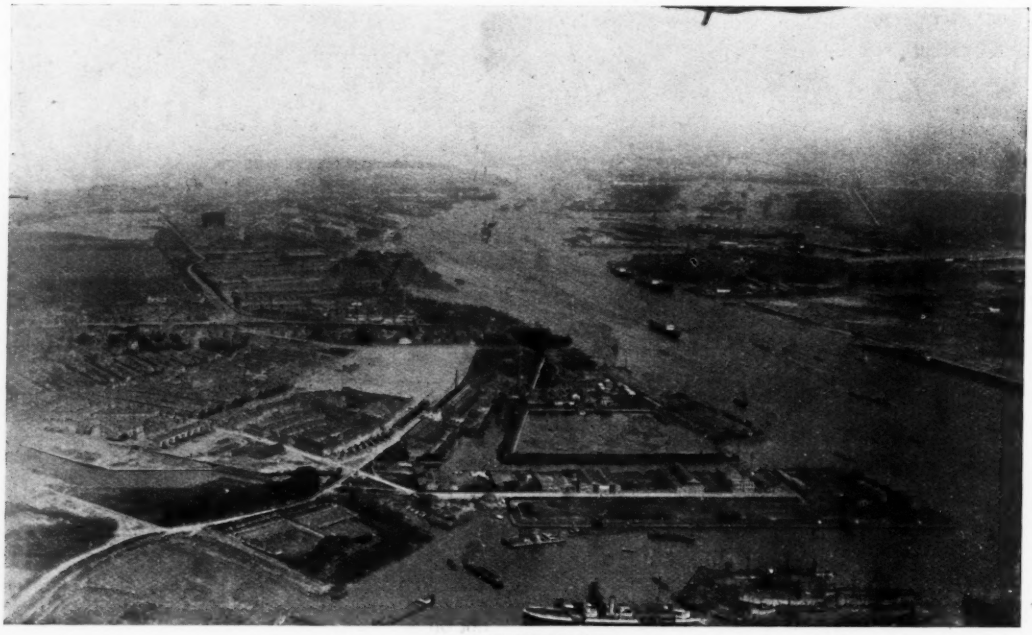

FIG. 3.—ROTTERDAM.
Passed over on the London-Amsterdam route.

danger, it is well to bear in mind that aerial transport is yet in its infancy, but can already show a greater percentage of reliability and safety than any other form of transport at a corresponding or even much later stage of development. One has only to take into consideration the almost daily charabanc fatalities so realise the truth of this statement.

As regards actual figures, for the year ending September 1921, 4,559 Continental aircraft used Croydon. Of this total 1,315 were British, 1,436 French, 577 Belgian, and 295 Dutch. For the same period a total of 10,554 passengers were carried between London and the Continent, 5,424 being carried in British machines, 4,024 by French, 676 by Belgian, and 420 by Dutch companies. During this period the following casualties occurred on British air lines: pilots killed, 3; passengers killed, 4; third party killed, 0; pilots injured, 3; passengers injured, 2; third party injured, 0. The casualty rates during last summer work out at ·03 passengers killed per thousand carried, and ·03 passengers injured per thousand carried, whilst a total of 32,200 miles was flown over for every accident which occurred. Other figures show that one accident occurred for every 1,718 flights commenced. These figures, which are issued by the Air Ministry, show that air travel cannot be considered as unduly dangerous.

For the three months ending July 31, 1921, the British services between London and Paris came up to the high standard described as "100 per cent. efficient," whilst for the six months ending September 21, the average "efficiency" was 96 per cent.

Other European countries interested in civil flying are Belgium, which operates routes to London and Paris, and Denmark, which will enter the field this spring, probably employing German machines. Spain, too, is operating a regular service from Seville to Laraiche in Morocco, and has other services in contemplation, notably the airship service to South America already mentioned.

As regards comfort, everyone who has flown realises that air travel is the quickest method of getting from place to place, and speed in transit adds to comfort in travelling by taking away the monotony of long journeys. All machines now used on the airways are fitted with closed cabins carrying from two to twenty people. These cabins are invariably fitted with comfortable armchairs, and are generally well ventilated with windows which may be opened or closed at will. They are comparatively warm in winter and not unduly stuffy in summer weather. There is none of the jolting and banging experienced in rail and road travel; there is no dust or cinders to irritate the travellers' eyes; there is no excessive draught to injure delicate gowns. The sensation of bumping sometimes felt when flying low over hilly country on a hot day is the worst that can be experienced, and it is not nearly so bad as a sea voyage in comparatively calm weather. The views seen from the windows of the machine are generally good, and the panorama seen by the traveller is superior to anything of the kind which can possibly be obtained by people who travel by old-fashioned methods.

All cross-Channel companies provide their passengers with life-belts which automatically inflate from a compressed-air condenser by moving a small lever. This is to guard against danger in the event of a forced landing in the Channel, though all the machines will float a certain length of time on water, and since civil aviation commenced there are only two recorded instances of commercial machines having to descend in the Channel. In addition most aeroplanes have an emergency outlet at the top of the cabin as well as a normal entrance by a full-sized door. At least one company has a map of the route inserted inside the cabin on which the exact position of the machine is shown by a pointer which the pilot moves as he flies over the route. It should be borne in mind that there is no necessity to wear special clothing when travelling by air. The most delicate costume will not get injured, and nothing more than a light wrap occasionally in summer, and an overcoat in winter, is needed by any traveller.

What is a Chemical Element?[1]

THE publication of Dr. Aston's monograph on a subject he has made peculiarly his own affords a convenient opportunity for a few reflections upon the change in our conception of a chemical element which recent research work has occasioned. The exact idea conveyed by the word "element" in chemistry and physics in the past has been more easily realised or felt by students than expressed in words. The textbooks told, and still tell, us that an element is a "body which has not been decomposed"; or, is "something to which we can add, but from which we can take nothing"; or, a "body which increases in weight with every chemical change." Such definitions have always been regarded as unsatisfactory because they were provisional; a time might conceivably come when they would be inapplicable to a given case. They took their stand, as Sir William Crookes pointed out, not on any attribute of things to be defined, but on the

[1] *Isotopes.* By F. W. Aston, D.Sc., F.R.S. (Arnold, 9s.)

limitations of human power; they were confessions of human impotence.

Now since it is known that all bodies are composed of atoms—the smallest particles of matter that can take part in a chemical change—it follows, it was argued, that an element must be composed of atoms of one kind only, for if it were composed of two or more kinds, it is very probable that someone, ere now, would have separated one from another, and that would contradict the definition of the word.

In the old days, then, an element was believed to be an assemblage of atoms each of which had identical properties. The truth revealed by experiment, however, differs from the conclusion of the argument above. We now know that what was called an element may contain atoms of different kinds, but—and this is important—although these kinds differ in a few respects, in most they are so similar that they cannot be separated by any known chemical process. Had this conclusion originated in a man's mind as a bright idea, it would surely have been rejected as making unnecessarily complex something essentially simple. Yet the experiments of workers on radio-activity in the years immediately preceding the war, and of Dr. Aston on positive-rays in the years since, have rendered it extremely probable.

Let us take an example from Dr. Aston's book. The metallic element magnesium, whose atomic weight is 24·32, is found to consist of three bodies having atomic weights of 24, 25, and 26. Each of these, as far as we know, is an assemblage of absolutely similar atoms, and therefore is an element in the old sense. Magnesium, on the other hand, although it is known by physical means to be a mixture of the three, cannot be separated by any known chemical process into its constituents. Not being decomposable, it too is an element.

Which, then, is to be called an element, the embracing whole or the constituent part? If the three magnesiums be called elements, they must be given distinguishing names and a new name must be invented for their mixture; also the word "element" would then mean something different from what it has meant in the chemical and physical literature of the past century. The difficulty is best resolved in this way. It is known that each of the three magnesiums gives absolutely the same X-ray spectrum, which is, therefore, that of the composite body. Now the X-ray spectrum is believed to be the most fundamental property of a chemical element. It is an excellent thing, therefore, on which to base a definition. Ninety-two (but only ninety-two) different X-ray spectra are known to be capable of existing in nature, and eighty-seven of these have actually been found in an examination of bodies. It is simplest, therefore, to make the X-ray spectrum the distinguishing criterion of a chemical element and to define an element as a substance possessing a unique X-ray spectrum. On this view there can be but ninety-two different elements of which eighty-seven are known.

It follows from this that if a substance is shown by the positive-ray method or otherwise to be a mixture of non-separable constituents, the mixture is called an element; if it is shown to be wholly one constituent, that too is called an element. Each of the constituents of the mixture which comprise the element is called an isotope. An isotope, but not necessarily an element, is consequently an assemblage of absolutely identical atoms. Those elements which are found to be mixtures of isotopes are called "complex" elements, those which cannot be resolved into isotopes, "simple" elements. Remembering that isotopes are non-separable, we arrive at the following description of an element: *A substance with a unique X-ray spectrum, which may or may not be a mixture of isotopes, and which cannot be decomposed into anything simpler by any known chemical process.*

The following elements have been found to be simple (I quote from Dr. Aston's book): hydrogen, helium, beryllium, carbon, nitrogen, oxygen, fluorine, sodium, phosphorus, sulphur, arsenic, iodine, and cæsium. Of the elements found to be complex, lithium, boron, neon, silicon, chlorine, argon, potassium, nickel, bromine, rubidium, actinium, protactinium, uranium, and possibly calcium, consist of two isotopes; magnesium and possibly silicon of three; thallium and possibly zinc of four; xenon of five; krypton and possibly mercury of six. The elements which have not been classified remain still to be investigated.

A. S. Russell.

Some Religious Beliefs and Survivals in Rural Japan

By the Rev. Walter Weston, M.A., F.R.G.S.

Late British Chaplain at Yokohama

Nothing so strongly shows the contrasts between the Japanese townsman and the Japanese peasant as a growing familiarity with the religious ideas and customs of the vast majority of the peasantry and of the dwellers in the remoter regions of the interior. They are a shy folk in these matters, simple-minded, and not

at all ready to talk to the stranger about either the details of their old-world practices or the principles on which those practices are based. Such details will only be gleaned by one who has been able to move among them during years of friendly intercourse, and to gain their confidence without exciting suspicion either by the inquisitiveness of the investigator or the superiority of the critic.

The present paper is an attempt to illustrate, mainly from personal observation, some of the popular ways of regarding the unseen powers that lie behind the phenomena of the visible world, and of the observances that are the natural result of that outlook upon it. It must be owned at the outset that the subject is one in which the modern and very much up-to-date representative of that Japan which is, and very naturally, chiefly concerned with its own wonderful achievements in the adoption of Western civilisation, takes little interest, and for which it has but little use.

The religious ideas of rural Japan with which we are now dealing are such as have been widely held almost from the dawn of the nation's history, and for the most part long preceded the introduction of Buddhism from China in A.D. 552. For the purposes of the present paper it may be convenient to define religion as that which includes all man's relations with the Divine, while religious conduct may be said to consist in doing that which is pleasing to the superior powers and in refraining from such acts as may be thought offensive to them. While not forgetting the influence exerted in the past by the ancestor-worship and Buddhism mainly derived from abroad, the real religion of rural Japan may broadly be described as a deification of the powers of nature by a people who were on every hand, and to an extent beyond all other peoples, not only in closest contact with the operations of those powers, but possessing every reason to study their workings and to desire to be on the best possible terms with them. The character of the Japanese peasant's religion cannot clearly be understood until we realise the enormous influence exerted on his whole outlook upon life by the physical surroundings in which he dwells.

In no other land of a similar area do the aspects of nature combine such a variety of grandeur, destructiveness, and beauty. Almost everywhere volcanic eruptions and earthquakes are frequent; towns and villages on the sea-coast are often much damaged by tidal waves; and the typhoon is more dangerous on the mainland even than at sea. The floods of rain that never fail to usher in the summer and autumn seasons frequently leave behind them landslides and inundations which take a heavy toll of life and precious farm land. Along the jagged coast-line the winds and currents are changeable, and perplexing to the mariner and fisher-folk, to whose arduous toil fresh dangers are added by the sunken and half-concealed rocks that so often line the shore. On the other hand, the splendour of a vegetation which includes more than half the known varieties of flowers, shrubs, and trees in the world, the varied beauties of the landscape, and an atmosphere of unusual clearness, unite to persuade the Japanese peasant that his land is one on which the "gods" are looking down with special favour. So it comes to pass that his outlook on that spirit world behind things seen is one of trust and hope, of reverence, and often of affection rather than of repulsion and dread. And we do not wonder, therefore, that on every attainable lofty mountain peak, by each lake and cascade—indeed, at whatever spot excites the imagination of the beholder by its beauty or its suggestion of power—there is almost certain to be found a shrine set up to the *genius loci*.

While two-thirds of the cultivated land is occupied by the rice-crops, three-quarters of the whole area of the country is composed of mountains, many of which rise to a height of upwards of 10,000 feet, and form a conspicuous part of every view. The rice-fields are held to be under the special care of Inari Sama, the Goddess of Food, in whose honour are reared many gaily-painted shrines, and at whose special festival,[1] early in the spring, intercessions are offered on behalf of a fruitful harvest later in the year. The attitude of the country-folk towards this divinity is mainly that of a sort of respectful familiarity and gratitude. For most of the mountains, however, there is manifested a reverential awe usually inclining towards fear. The sentiment often varies with the nature of the peak and its capacity for help or harm. Of the hundreds of volcanoes whose graceful forms rise in every part of the country, no less than fifty are active, and some of them prove a frequent source of disaster to life and property. On most mountains there are shrines to their guardian divinities. In two cases hereditary caretakers are attached to them, who make appropriate offerings to the divinity on important occasions.

I pointed out in the paper already alluded to in a footnote, that most of the popular festivals of rural Japan are those connected with the crops, on which in the long-run the chief prosperity of the country depends. A striking, though very little known, example of this came to my knowledge some years ago, the scene of which was a Buddhist temple called *Bukkyoji*, near the town of Tsuyama, in the province of Mimasaka in Central Japan. This festival is called *Go-ho*, and the title of the divinity in whose honour it is held is *Go-ho-zenjin*, i.e. "the good god who protects the ears of corn." Its object is to supplicate

[1] See DISCOVERY, Vol. II, No. 21, p. 229.

that being to protect the growing rice-crops from the depredations of the crows, and it is its connection with those birds that gives it some of its characteristic features. Into all the details of the weird and significant ceremonial we have not now time to enter, though they are the more striking from the fact that they are carried out at the present day quite close to a railway traversing the centre of the mainland of Japan.

The principal figure of the proceedings is a member of a family of farmers, in which the office of *Eri-dane*, or "Chosen Seed," has been hereditary for many generations. On July 16 (old style), at midnight, in the precincts of the temple, which are illuminated by huge torches of bamboo, a solemn invocation of the Sama, the Buddhist incarnation of the God of Crows, descends and proceeds to reincarnate himself in the person of the *Eri-dane*. This service lasts about half an hour, and at its conclusion the medium, now "possessed" by the spirit of the god, leaps up and dashes wildly about the enclosure, supported by a priest on either hand to prevent him from hurting himself by falling to the ground, or by colliding with the trees and walls surrounding the temple grounds. These exercises, relieved with intervals for rest, are prolonged for about an hour and a half, and the whole proceedings are watched by large crowds of peasantry from the surrounding countryside with mingled amusement and awe. At length the wander-

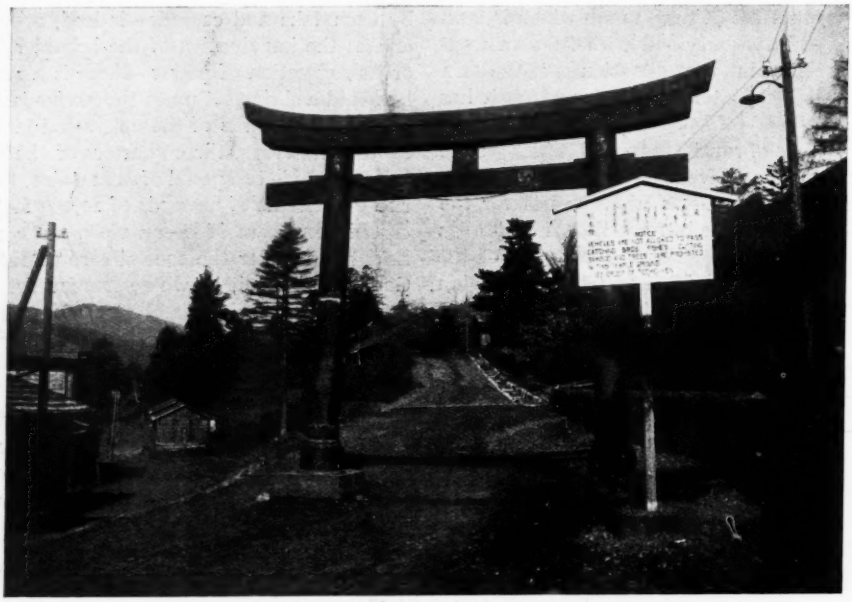

FIG. 1.—THE OLD AND THE NEW SIDE BY SIDE IN JAPAN.

The *torii* (sacred gateway) at the foot of Nantai-san, the holy peak above Lake Chuzenji, near Nikko, in Central Japan. Note the electric light, the telephone wire, and the English translation of the notice.

god takes place to the accompaniment of the blowing of conch-shells and the shrill rattling of the *shakujo*—the official staves of the Buddhist priests hung with rings of brass. Presently the *Eri-dane*, who has previously undergone a period of rigorous ascetic training, accompanied by frequent lustrations at a spring sacred to the *genius loci*, is led in and placed before the shrine. He is dressed in ceremonial garments and bound about with ropes of straw to prevent injury in the subsequent proceedings, and with his arms outstretched so as to resemble the wings of a hopping crow, is seated on a mat under a canopy of maple boughs. Fifteen young men stand round him and chant the office of the *Harai*, or service of supplication, in answer to which Fudo ing rushes of the *Eri-dane* lead him to the sacred water once more, this time under the direct guidance of the god, who now prompts him to apply it to his person. No sooner has it touched his face than he is instantly "dispossessed," and the spirit of the god now returns to the *gohei*—the sacred wand of *sakaki* wood, hung with strips of white paper, always found in Shinto shrines—in the temple on the mountain top. As the spectators depart they carry away with them fragments of the burnt-out torches and set them up in their fields as scarecrows of unique and universal efficacy.

Sir James Frazer has kindly pointed out to me the classical parallels to the foregoing in the worship of

Apollo Smintheus (" Mouse Apollo ") and of Dionysus Brassareus (" Fox Dionysus "). Such worship was probably addressed originally to the Lord of the Mice (himself a mouse) and to the Lord of the Foxes (himself a fox), in order to induce them to use their authority with their subjects in forbidding them to ravage the fields and vineyards of the suppliants. The worship of Baal-zebub (" Lord of the Flies ") was also, perhaps, similarly designed as a means of getting rid of plagues of flies, and the Greeks themselves are known to have adopted similar rites.

The ceremony of the *Go-ho* just described I found, upon investigation, to be connected with another strange cult, of wider scope and more elaborate ritual, known as *Kami-oroshi*. This is mainly practised by the most popular of those pilgrim clubs whose chief object is to seek spiritual enlightenment and, incidentally, certain material benefit, by the ascent of those sacred mountains which are held to possess special sanctity and to afford the closest opportunities of personal intercourse with the invisible powers dwelling on their summits. *Kami-oroshi* means " bringing down the god " and refers to the rite in its general aspect, while *Kangakari* (" causing the god to rest ") refers rather to the climax of the ceremony, the point at which the god is believed to have actually taken up his temporary abode in the person of the chosen " medium," through whom he is now about to communicate with those who have come to seek his aid. Little is known to the outside world of these " mysteries," the ritual and psychology of which provide a study of exceeding interest and of some scientific importance. The limits of the present paper, however, only permit of a brief reference to the main features of the practice itself, based upon the actual experiences of the writer on the spot.

The pilgrim clubs are known as *Koju*, and their ascetic members are called *Gyoja*. The Mecca or, rather, the Delphi, of their cult is the great extinct volcanic peak of Ontake-san (*san* means mountain), which lies to the north of the famous Nakasendo, " the inner mountain road," in Central Japan. The Nakasendo railway line also now passes within a few miles of the southern base of the mountain, and affords easy access for the numerous pilgrim bands who throng its slopes during the short climbing season of midsummer, when alone it is the goal of their journeyings.

FIG. 2.—AT THE DOOR OF THE SACRED SHRINE ON THE TOP OF FUJIYAMA.
The original shrine was first built 1,100 years ago. The man on the right with the white fillet round his head is the *Kannushi*—" Guardian of the God "—of the mountain.

The first introduction of the writer to the " séance " itself was on the summit of Ontake-san some years ago. Concealed behind the topmost shrine, a party of white-robed *gyoja* sat in Indian file facing the member of the band acting as the medium (*nakaza*—" seat between ") between themselves and the gods they had come to consult. At their head and facing him was one who, under the title of *maeza* (" seat before "), played the part of precentor and spokesman on behalf of the rest. The *nakaza*, with closed eyes,

sat silent and still, holding between the palms of his outstretched hands the sacred *gohei*, while the rest broke out into a subdued *Harai* addressed to the

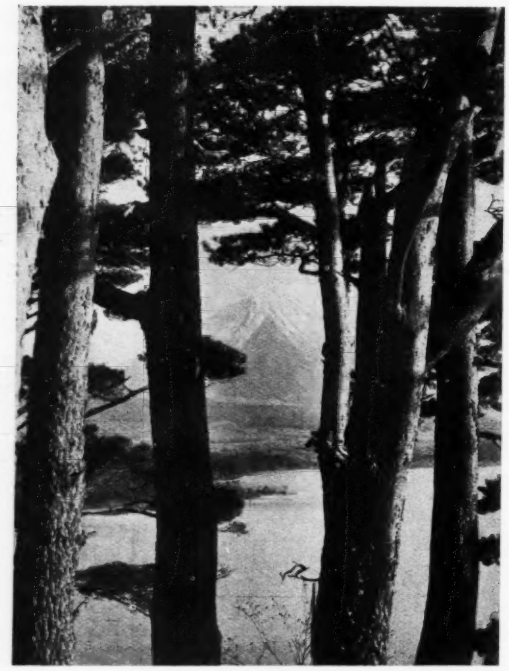

FIG. 3.—FUJI-SAN THROUGH THE PINE-TREES ABOVE THE LAKE OF SHOJI.

mountain divinities of Ontake. Soon the face of the medium assumed a livid hue, unearthly gaspings issued from his throat, and the *gohei* now began to tremble violently in his grasp. His eyes turned upwards in their sockets until only half of the iris was visible, and a series of convulsive jerks at length brought the *gohei* to a standstill above his forehead—the god had come down upon it. Thereupon the *maeza*, bowing low towards the medium until his forehead touched the ground, reverently inquired what might be the "honourable name of the august visitor" whose presence had now replaced the personality of the *nakaza*. In a hoarse whisper came the answer, "I am Fukan Reijin"—this being the posthumous title of the canonised mountaineer who, in a dim and distant past, had made the first ascent of Ontake-san, and in whose honour, at that precise moment, a solemn festival commemorating it was being held at the ancient shrine at the mountain foot nearly 10,000 feet below.

As soon as the *maeza* heard the name, he began to prefer the requests of those pilgrims who had boons to crave. They were so simple that one wondered they should have been accompanied with so much reverence and mystery: "What sort of weather shall we be granted on our homeward way from the holy mountain?" "What about the health of those we have left at home?" "Will business prosper during the coming year?" and so forth. In a low voice the medium pronounced the replies the god saw fit to make, all quite orthodox in their oracular vagueness. When all the questions had been suitably dealt with, the medium lowered the *gohei* in token that the god had departed from his temporary abode, and that he was "coming to himself" again. The *maeza* then arose and with well-meant but necessary vigour fell to pounding and kneading the body and limbs of the medium, so stiff and rigid had they become in his cataleptic trance. Presently he came to, and then the party proceeded on their way, having taken no more notice of my presence than of the stocks and stones around them.

Later in the day, on our way down the mountain, I asked of the *sendachi*—the leader of another band of *gyoja*—the reason of the white clothes always worn by them on these pilgrimages. His explanation is deserving of record: "Unless we are striving to do right with our hands and to think right thoughts in our hearts, the gods will not commune with us nor answer our prayers; these white garments, therefore, are the symbol of the purity we seek." The words vividly recalled the Psalmist's own pronouncement: "Who shall ascend into the Hill of the Lord, or who shall rise up into His Holy Place? Even he that hath clean hands and a pure heart."

Among the Oracles of the ancient Shinto shrine of Kasuga, near Nara, the god declares: "We will refuse to enter the house of the depraved and miserly. . . . Hear, all men! If ye desire the help of the gods, put away pride. Even a hair of pride shuts ye off from the gods as if it were a great cloud."

To the Divinity of Fuji is ascribed a similar exhortation: "Ye men of mine! Shun desire. If ye shun desire, ye will ascend to a level with the gods. Every little yielding to anxiety is a step away from the natural heart of man. If anyone leaves the natural heart of man, he becomes a beast."

Mingled with all the reverence, admiration, and love cherished by the Japanese towards the idolised form of Fuji-san, there is nevertheless an element of awe which, though seldom outwardly manifested, is very real. A curious instance of this was experienced some years ago by the writer and two Cambridge friends who were anxious to make the ascent at an unorthodox season, while the mountain was still wearing its dazzling mantle of hitherto untrodden snow. The village fathers, the local police, and the priests of the ancient shrine of Omiya, at the base of the peak, the most important of the formal starting-

points for the ascent, earnestly warned us against the attempt. "For," they suggested, "the goddess of the mountain is not at home to visitors before the official *Yama-biraki* (mountain-opening), in the middle of July," and with dire forebodings we were warned to "look out for squalls" if we persisted.

No sooner had we reached our bivouac in the forest on the edge of the snow-line than a typhoon burst over the mountain and kept us prisoners for three days. At length, on a cloudless morning we were set free and reached the summit in a climb of seven hours, deserted by all our coolies save one. Traversing the peak we descended on the opposite side to Gotemba, so that our friends of Omiya saw us no more. A week or two later, the leading Japanese newspaper in Tokyo came out with the following account of a terrible disaster: "The foreigners who recently started to ascend Fuji with four coolies have not since been heard of . . . they were urged to postpone the attempt, but they were determined to go. As they have not since been heard of, it is feared they have either succumbed to the fury of the gale, or died of starvation. Their nationality is unknown, but it is surmised that they are British for the reason that the people of that nation like to do that which is distasteful to them and glory in their vigour."

A possible explanation of the fear of vengeance on the part of the offended divinity of the mountain is suggested by the name "Fuji," which is probably derived either from the Ainu word *push*, "to burst forth," or from "Huchi," the name of the Ainu Goddess of Fire. Other place-names in the neighbourhood are also of Ainu origin and take one back to the days when, before they were driven northwards by invaders, those hairy aborigines dwelt at the foot of the greatest mountain in Japan and, watching its fiery activities with mingled awe and terror, made it the supreme object of their worship.

The chastisement of sacrilegious and unwelcome visitors as a token of the resentment of the spirits of the greater peaks is at times a forcible proof, in the eyes of the rustics living beneath their shadows, of the need of care in approaching their sacred precincts.

On the mountain of Hodaka-yama, in the Northern Alps, this was brought home to me with painful force. After making the first ascent by a European traveller, I was attacked on the way down through the depths of a gloomy forest, and badly stung, by angry inhabitants of a wasps' nest. Later in the evening, as I was drying my wet garments at the camp fire, a Japanese traveller also bivouacking there approached me with a request to show him the wounded spots on my "honourable body." Presently I turned round and found him engaged in making a series of mesmeric passes over them. He then arose and, standing in the doorway of the hut, clapped his hands and bowed his head in supplication to the spirit of the mountain. He then approached me once more and in a hoarse whisper exclaimed, "This is *majinai* ("magic"): you will be all right in the morning." He went on to explain that I—a sacrilegious foreigner—was the object of the resentment of the offended divinity, and that what looked and no doubt felt like wasps were but the embodied spirits of her retribution. This goddess is held to possess special power over wind and storm, and the rite of *amagoi*, ("praying for rain") in times of drought, is believed to be unusually efficacious when performed at the little shrine in her honour at the mountain foot.

It will be gathered from the foregoing illustrations that it is as true of the rural Japanese as it was of the ancient Greeks that "around their mountains more than all other spots did mythology most closely gather as the home of the gods and as the most frequent scene of their intercourse with men."[1] And just as the Chinese pilgrim to-day wends his toilsome way to the summit of the precipices of Mount Omi,

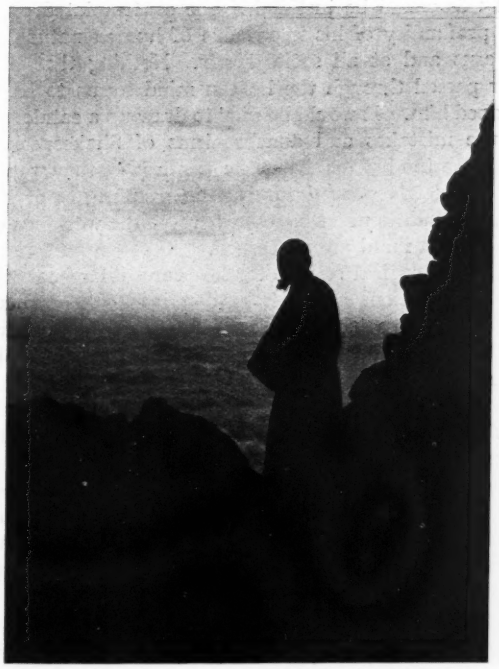

FIG. 4.—A PILGRIM ON THE SUMMIT OF FUJI-SAN (12,400 FEET) WORSHIPPING THE RISING SUN FROM THE PACIFIC, BEYOND THE SEA OF CLOUDS.

in the province of Such'uan, where the pure in heart are promised the vision of the "Light of the Glory of

[1] *Lectures on the Geography of Greece*, by H. F. Tozer. (John Murray.)

Buddha," so, in the hut of the Japanese *gyoja* on Togakushi-san in Shinshiu, I was assured that the mountaineer with sufficient faith, who should be there at early dawn, would behold Amida Buddha riding on a cloud of many gorgeous hues.

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Biology in Shakespeare I.

By D. Fraser Harris, M.D., D.Sc.

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SHAKESPEARE has been called a complete intellect; and this would be justified if one contemplated only the profundity of his knowledge of human nature in all ages and at all social levels. Nothing that has ever passed through the human mind seems to have escaped him. It would be easy to draw up a catalogue of the mistakes and anachronisms of Shakespeare; but were the list ten times the length it is, they would be completely atoned for by the penetration of his instinct and its unerringness wherever the workings of the human mind are concerned.

If in biological science Shakespeare did repeat the mistaken notions current in his day, it may be none the less interesting to examine some of these in detail, and by the light of our modern knowledge of life endeavour to understand just what phenomena they were that engaged Shakespeare's attention.

The question arises, did Shakespeare know the physiology current in his day, and, if so, did he give expression to what was generally believed, or, as regards the matter of that science as in so much else, did he transcend the views current in his time and flash forth beyond them in prophetic prevision?

It happens that Shakespeare lived at a time when most momentous discoveries were taking place in physiology. Shakespeare and the world-renowned Dr. William Harvey, the discoverer of the circulation of the blood, were contemporaries for some thirty-eight years of their lives, for Shakespeare was born in 1564 and died in 1616, while Harvey was born in 1578 and died in 1657. Harvey was thirty-eight years old when Shakespeare died. By 1616 Harvey had not, however, announced his epoch-making discovery which was published in 1628, and even then not in England, but at Frankfort-on-the-Main.

It is rather curious to remember that the earliest writings of Harvey known to contain any description of the circulation of the blood, in which the heart is regarded as the central power for it, are dated 1616. These are none other than Harvey's manuscript notes for his Lumleian lectures, the first of which he delivered at the College of Physicians on April 16, 1616. These precious leaves accidentally discovered have been bound together and now repose in the British Museum.

Seeing that Shakespeare died on April 23, 1616, it is at once apparent that he could have known nothing of the Harveian views on the circulation of the blood, the starting point of modern physiology, for the *Exercitatio de motu cordis et sanguinis in animalibus* was not printed for twelve years after that date. Thus Shakespeare could not have known of his great contemporary's discovery because he died twelve years too soon. Neither could Shakespeare's son-in-law, Dr. Hall, of Stratford-on-Avon, have told him of it, as some have thoughtlessly suggested he might, since, for one thing, Hall married Shakespeare's daughter as early as 1607. Some uncritical writers have assumed that Shakespeare must have known of the circulation of the blood because he was a contemporary of Harvey. But the two great men may never have met. Harvey was a student of medicine at Padua from 1598 to 1602, the very time when Shakespeare was at the height of his activity.

Even if they did meet, the young doctor was not in the least likely to discuss with the great actor his revolutionary view of a matter of pure physiology. If Harvey discussed so technical a subject before he gave it to the world, it would have been exclusively with his medical brethren. We should expect from *a priori* considerations, without examining Shakespeare's works at all, that their author was not acquainted with the new views concerning the circulation of the blood. A close examination of these writings confirms this opinion in the fullest manner.

If Shakespeare, then, was not acquainted with the Harveian doctrine, what view did he know? The reply is that he evidently held the views which had been taught in the medical schools of Europe for 1,400 years —the views of Claudius Galen.

The Galenical notions of the movement of the blood can be understood only after still earlier views are comprehended. The distinction between arteries and veins was made before even the time of Aristotle. Shortly after the death of Aristotle, Erasistratus (300 B.C.), of Alexandria, thought that blood for the nourishing of the body travelled up and down the veins only; whereas in the arteries "vital spirits" alone were found. Erasistratus thought that arteries during life did not

contain blood because after death arteries are found to be empty. By vivisectional methods Galen made the discovery that the arteries contain blood during life. According to him the veins contained "crude" blood, the arteries pure or spirituous blood, that is, blood mixed with vital spirits. The Galenical doctrine of spirits, on which learned Europe subsisted for a millennium, was somewhat complicated as it recognised no less than three different kinds related somewhat in the following manner. The food in the intestine was supposed to be absorbed into the liver, where it was elaborated so as to be possessed of "natural" spirits. This crude blood then passed to the right side of the heart, into which all the veins of the body opened. This blood, still crude, was supposed to nourish the body by passing up and down the veins as by the ebb and flow of a tide. Its "natural spirits" in modern terminology would be equivalent to "powers of nourishing." Most of this crude blood was supposed to percolate through invisible pores in the septum or partition that divides the right from the left ventricle of the heart, only a little of it going round by the pulmonary artery to nourish the lungs. In the left ventricle the blood was supposed to be mixed with air inhaled in the act of breathing. Aristotle taught that the inspired air was needed to cool the "innate heat" of the heart; Galen adopted this view and added another result of the mixing of blood and air, namely, the elaboration of "vital spirits." The great arterial vessel of the body, the aorta, arises from the left ventricle, so that blood plus vital spirits passed by the arteries to the tissues and organs to confer on them the powers of performing their specific functions. The vital spirits, therefore, promoted functional activity of the tissues. Finally, said Galen, blood plus vital spirits is carried to the brain—an organ which Aristotle declared was cold and bloodless—and there becomes the seat of the production of a third order of spirit—the "animal." This production of animal spirits was supposed to go on in the ventricles or cavities of the brain. These animal spirits, which as a term survive only in colloquial English, were to Galen what nerve-impulses are to us; but they were a great deal more, for they were the very instrument of the soul itself. The word "animal" does not in this connection mean "belonging to a beast"; it means pertaining to the soul or *anima*, the Latin equivalent for the Greek *psyche*, the life or soul. The full Latin expression is *spiritus animalis*.

The animal spirits of Galen are in modern language equivalent to consciousness generally, and to motor and sensory innervations as well. Such is a simplified account of the doctrine of spirits which was the orthodox medical teaching as late as during the lifetime of Shakespeare. It persisted in common parlance until long afterwards, for in the reign of Queen Anne (1708) the *Daily Courant* advertised a perfume as efficacious because "it increases all the spirits, natural, vital and animal," which is quite in the Galenical order.

Let us now examine the passages in Shakespeare's writings in which mention is made in some sort or other of blood, blood-vessels, or heart.

In *Love's Labour's Lost* (Act IV, Sc. 3) we have the expression: "The nimble spirits in the arteries," a direct echo of the Aristotelean-Galenical teaching.

The veins are mentioned much more frequently. In *King John* (Act III, Sc. 3) we find the expression "blood . . . runs tickling up and down the veins." The interest in this is, of course, the phrase "up and down," which is precisely what was taught as regards blood in veins before the unidirectional flow of blood was demonstrated by Harvey. The pre-Harveian notion of a tide, that is, an up and a down, a to and fro movement in the veins is exactly reproduced in this passage. In the same play we find the line

> "Whiles warm life plays in that infant's veins"—

and are at once reminded of the exceedingly old belief that the life was pre-eminently in the blood. Not only do we have in the Hebrew Scriptures the phrase, "for the blood is the life," but also find the same idea in the Hippocratic writings. The Hippocratic writer based his belief on the familiar observation that, when the blood has run out of the body of a slaughtered animal, the animal dies.

Once more in the same play we have this idea quite distinctly put (*King John*, Act V, Sc. 7): "The life of all his blood is touched corruptibly."

Possibly the best-known passage in which the movement of the blood is alluded to is in *Coriolanus* (Act I, Sc. 1), where Menenius Agrippa, a friend of Coriolanus, speaking of the belly, says:

> "True it is . . . that I receive the general food at first
> Which you do live upon, and fit it is,
> Because I am the storehouse and the shop
> Of the whole body: But if you do remember,
> I send it through the rivers of your blood
> Even to the court, the heart—to the seat o' the brain,
> And through the cranks and offices of man,
> The strongest nerves and small inferior veins
> From me receive that natural competency
> Whereby they live."

Now, while it is quite absurd to see in this not only modern physiology but a prophetic vision of Harvey's discovery, the passage is not wanting in biological interest. The general idea of the abdominal viscera receiving food and working it up into the blood destined for the nourishment of the whole body, including the nerves and brain, is involved in this passage and so far is physiologically correct. But undoubtedly it is

the phrase "rivers of your blood" that should arrest us, for, if literally accepted, it does indicate the notion of a flow in one direction only. The flow of a river is the very opposite of a tidal flow.

To insist, however, that, because Shakespeare used the expression "rivers of blood," he actually foresaw the discovery of the circulation, is to read a great deal too much into this passage; possibly he meant no more by "rivers" than if he had said "streams." If we had none other than this passage to go upon, we might admit that Shakespeare had before him the Harveian notion of a flow only in one direction; but in the light of what he writes in Act V, Sc. 1, of the same play—

> "The veins unfilled, our blood is cold, and then
> We pout upon the morning, are unapt
> To give or to forgive; but when we have stuffed
> These pipes and these conveyances of our blood
> With wine and feeding, we have suppler souls
> Than in our priest-like fasts"—

we cannot but believe that Shakespeare held no view other than the Galenical one of his own day, namely, that the veins, not the arteries, convey the nourishment to all parts of the body. The revivifying effect of alcohol taken with food is fully appreciated in this passage.

That distinguished man of science, Steno the Dane, was violently criticised for his irreverence in asserting that the heart—the seat of the soul—was in its essence none other than a common muscle.

Shakespeare seems to have had an inkling of the pre-eminence of the beating organ in the chest; he knew not only fairly accurately where the heart-beat is, but how emotions directly affect it, as when Macbeth exclaims,

> "Whose horrid image doth unfix my hair,
> And make my seated heart knock at my ribs."

One of Shakespeare's allusions to blood reaching the heart has been made a good deal of by certain writers on the history of physiological discovery. The passage is in Julius Cæsar (Act II, Sc. 1) where Brutus exclaims,

> "You are my true and honourable wife,
> As dear to me as are the ruddy drops
> That visit my sad heart."

All that this asserts could be known from observing slaughtered animals, namely, that blood is in the heart; and yet some writers have gone so far as to maintain that Shakespeare anticipated Harvey in the matter of the dicovery of the circulation. This is excess of hero-worship.

There is, however, quite a striking passage in *Measure for Measure* (Act IV, Sc. 3), where the heart is mentioned in a new connection:

Lucio: "O Pretty Isabella; I am pale at mine heart to see thine eyes so red."

The thought in Shakespeare's mind was probably that the emotion of sorrow or sympathy blanches the heart in the same way that some emotions blanch the skin of the face. While the literal physiology of this is incorrect, there is the recognition of the important effect of psychical states on the condition of the heart.

(*To be continued*)

Reviews of Books

NEW REVELATIONS OF BYRON'S PERSONALITY

Lord Byron's Correspondence, chiefly with Lady Melbourne, Mr. Hobhouse, The Hon. Douglas Kinnaird, and P. B. Shelley. With Portraits. Edited by John Murray, C.V.O. In two volumes. (John Murray, 25s.)

The French Revolution and the subsequent Napoleonic Wars threw a strange assortment of men to the surface not only in the world of politics, but also in literature. The events of these years stirred men to their depths, and, so far as our poets were concerned, drove them out of the "polite society" of Bath and the "coffee taverns" of London, to wander again through the green fields of England, or across the Continent, and made them face the realities of life, not in a library chair, but in the open world and amongst other human beings. As the nineteenth century wore on poets began to return to London clubs and drawing-rooms, and we find Tennyson, the author of *The Idylls of the King*, reigning as the literary lion in the place of Byron, the author of *Don Juan*. Tranquillity flows through Tennyson's works, even through the most passionate stanzas of *Maud*, but a blast of passion and strong emotion surges through Byron's poems.

Byron appealed to an age of unrest and violent contrasts. His character was, indeed, a strange blend of opposing tendencies. After his death our Victorian ancestors exaggerated all his worst qualities, and handed on to us the picture of a haughty, sneering aristocrat, who lived the life of a depraved and selfish debauchee, and wrote immoral poems which no young person should be allowed to read. That is only a one-sided picture, and we believe that these two new volumes of his letters will help to shed a more kindly light on his life and personality.

There was something both of the *Dr. Jekyll* and of the *Mr. Hyde* in Byron's make-up, though he never reached such extremes of kindness or of cruelty. It is impossible to put a good reflection on such matters as his treatment of Clare Clairmont, the attitude he adopted towards Leigh Hunt and his family on their arrival in Italy, his readiness to believe slanders about his friend Shelley (see vol. ii, p. 183), his numerous dislikings of people and his habit of loudly voicing them. These seem to us more inexcusable than any of his *amours*, for there is an inhumanity about them. Yet, taking the man with all the handicaps with

which he entered on life—his violent-tempered mother, his admission to the peerage when quite a boy, his extreme handsomeness, and, most important of all, the deformed foot which denied an athletic body its full outlet of energy—we should rather be surprised at the fine and more generous qualities which he displayed. His deep and lasting friendship with Hobhouse, his affection for his old servant, Fletcher, his generosity in lending and giving money, his championship of the cause of Greek independence (resulting in his death)—these were some of the truest things in his life. But we must let the new letters speak for themselves.

The present collection belonged to John Cam Hobhouse, Byron's great friend already referred to. At his death they passed into the hands of his daughter, Lady Dorchester. Lady Dorchester died in 1914 without having published them, and bequeathed them to Mr. Murray, who has now edited them. In the first volume we have the poet's letters to Hobhouse, written during his travels in Greece and Turkey, from 1808, when he was twenty, to 1811, and soon after his return to England, and his letters to Lady Melbourne, covering the period 1812—the year in which he " woke one morning and found himself famous " after his first speech in the House of Lords and the publication of the first two cantos of *Childe Harold*—to the end of the first three months of his married life, in April 1815. The second volume, by far the most interesting of the two, covers the period of his exile in Italy, 1816–1823, and his expedition to Greece, 1823–1824. It contains correspondence with various persons in England, chiefly Hobhouse and another friend, Kinnaird, and a large number of valuable letters, as we shall see later, written to him by Byron's fellow-exile in Italy and contemporary poet, Shelley.

On account of space we must content ourselves with drawing a few extracts out of the two volumes. In August 1810 Byron was staying at the convent in Athens, and in a letter to Hobhouse gives a charming pen-picture, touched with a kindly irony, of the Abbot's young pupils, " my only associates " : " Of this goodly company three are Catholics, and three are Greeks, which schismatics I have already set a boxing to the great amusement of the Father, who rejoices to see the Catholics conquer. . . . We have nothing but riot from noon to night. The first time I mingled with these sylphs, after about two minutes' reconnoitring, the amiable Signor Barthelemi, without any previous notice, seated himself by me, and after observing by way of compliment that my ' Signoria ' was the ' piu bello ' of his English acquaintance, saluted me on the left cheek, for which freedom being reproved by Giuseppè, who very properly informed him that I was ' μεγάλος ' ; he told him I was his ' φίλος,' and ' by his beard ' he would do so again, adding, in reply to the question ' διὰ τὶ ἀσπάσετε ? ' you see he laughs, as in good truth I did heartily.

" But my friend, as you may easily imagine, is Nicolo, who, by-the-bye, is my Italian master, and we are already very philosophical. I am his ' Padrone ' and his ' amico,' and the Lord knows what besides. It is about two hours since, that, after informing me he was most desirous to follow *him* (that is me) over the world, he concluded by telling me it was proper for us not only to live but ' morire insieme.' . . .

" I am awakened in the morning by those imps shouting ' Venite abasso,' and the friar gravely observes it is ' bisogno bastonare ' everybody before the studies can possibly commence."

Hobhouse had accompanied Byron during the early part of these travels. When Hobhouse left for England, he owed Byron £818. It is typical of the latter's generosity that he writes to his friend from Malta in May 1811, though he did not at the time " know where to raise a shilling " himself, that " with regard to our account, don't think of it, or let your father think of it, for I will not hear of it till you are in a state to pay it as easily as so many shillings. I have fifty resources, and besides my person is parliamentary—pay your tradesmen—I am none."

Byron returned to England in July 1811. By 1813 he had reached the height of his fame and popularity in London Society. But he had, as the editor tells us, become " entangled in a social circle whose code of morality was lax, even judged by the standards of the Regency period." He began to entertain a genuine desire to meet and marry a woman who would " govern him." Unfortunately his great confidante of these years, Lady Melbourne, so encouraged his interest in her niece, Miss Milbanke, that his friendship with this lady, far too austere and cold for him, was manufactured into a semblance of love. It is regrettable that Lady Melbourne, who had hitherto exercised an influence all for the good upon Byron, should have ended in effecting a match that was to ruin his life in England and embitter, even more than before, his highly sensitive character. As to Annabella, she herself feared that " he was not the person whom she ought to select as her guide, support, and example on earth with a view to Immortality " ! And as to Byron, we find him writing of Annabella before their marriage in strains such as these : " She seems to have more feeling than we imagine ; but is the most *silent* woman I have ever encountered ; which perplexes me extremely " ; " she is, as you know, a perfectly good person " ; " Do you know I have grave doubts if this will be a marriage now ? Her disposition is the very reverse to our imaginings. She is overrun with fine feelings, scruples about herself and her disposition (I suppose, in fact, she means mine), and to crown all is taken ill every three days with I know not what " ; (this last, if you please, less than two months before their marriage). And what could be expected of a marriage when the husband writes during the honeymoon that " I have great hopes this match will turn out well " ?

The match did not turn out at all well, and Byron left England on April 25, 1816, pursued by the clamourings of his debtors and the censures of a society which was prudishly moral on the surface, whatever it was underneath. Arriving in Switzerland some months later, he met Shelley for the first time. Shelley, the younger poet, though never one of Byron's most intimate friends, exercised a strong and good influence on his life and poetry both there, and later on in Italy, and his letters to Byron, here first published, are of great interest. No two characters

could be so diverse as these two men's— a fact which is vividly illustrated by the juxtaposition of their letters in the second volume. It is, indeed, a peculiar sensation to turn over a page of high idealism, or some description of natural beauty expressed in the clear, suave prose of which the lyric poet was a master, and to be plunged on the next into a whirlwind of hot-blooded emotions, irony, wit, and vividly told *raconte* produced by the brilliant satirist.

The centenary of Shelley's death, off Lerici in the Gulf of Spezia, takes place in July of this year. The mystery attaching to the swamping of his boat in a sudden storm has never been completely cleared up. But a letter in this volume written by Byron to his bankers in September of the same year lends additional weight to the belief that the boat was rammed during the storm by a Genoese fishing felucca in the belief that Byron was on board with £50. "The extreme liberality of *Mr. Shelley's* disposition," Byron remarks, "generally left him in arrear, and the day before he was lost he borrowed of me fifty pounds which were on board in cash when the boat went down." In November 1875 Trelawny's[1] daughter wrote to him from Rome concerning a death-bed confession made at Spezia by an old sailor, "that he was one of the crew that ran down the boat containing Shelley and Williams, which was done under the impression that the rich 'milord Byron' was on board with lots of money." The letter confirmed Trelawny in his suspicions, and most biographers of Shelley have adopted this explanation of the tragedy. What still remains uncertain is whether there was any motive of revenge as well as greed. Byron had had several quarrels just before the disaster, and according to the old fisherman "they did not intend to sink the boat, but to board her and murder Byron."

Leigh Hunt,[2] a well-known contemporary literary critic, to whom Byron usually showed the harder side of his character, said that in his cups he became a changed person, and that it was then that he felt he was talking with the "true Byron"—a man only too desirous to give and receive an intense degree of sympathy. That softer side emerges often in these letters, where in writing to his most intimate friends we again encounter the mind of the "true Byron." As we have already noted, his deformed foot accounted more than anything else for the cynical twist in his mind. Like Pope, the satirical poet of the eighteenth century, he suffered from what our modern experts would call "dwarf psychology," though there is of course no doubt who was the greater man and the greater poet of the two.

E. L.

Ocean Research and the Great Fisheries. By G. C. L. Howell, M.A. (Clarendon Press, Oxford, 18*s.*)

Recently a leading Fish Trades Journal assured us that "the man who produces a really thoughtful work on the economics and the future of the fishing industry will deserve well of the nation." Presumably this book has been written in reply to that suggestion. Mr. Howell's qualifications for writing on our Sea Fisheries were obtained when he acted as Director of Fisheries in the Panjab; his knowledge of Ocean Research is based on a more slender foundation, since he is devoid of scientific training. Mr. Howell is an "expert" member of the Advisory Committee on Fishery Research to the Development Commissioners, and a member of the Freshwater Fisheries sub-committee to the same body. His book contains thirty-two chapters and ninety notes of interrogation, on the average about three to the chapter. The notes of exclamation are nearly as numerous, and the book is by no means free from minor errors and misprints. It purports to give an account of the natural history and economics of our principal marine fish.

In 1921 Lemon Soles to the weight of 31,714 cwts. and value of £153,023 were landed in England and Wales. Catfish and Dabs, which are more abundant and valuable than the Lemon Sole, are not mentioned by Mr. Howell. A chapter of barely four pages is devoted to the organisation of Ocean Research, another of less than five pages to the collection of fishery statistics, and there is a final chapter of fourteen pages on the "Small Game" of the sea.

Two extracts will suffice to give an idea of the author's literary style:

"Why do some herrings contract infant marriages, while others are still bachelors and spinsters in austere middle age?" (pp. 173–4).

"The Norwegians—who are the 'sea-daddies of the world'—can be relied upon always to 'think big'" (p. 179).

The only redeeming feature of the book is the excellence of the illustrations, the best of which appear to have been prepared by the scientific men engaged by the Local Sea Fisheries Committees, bodies for which on more than one occasion Mr. Howell has publicly expressed his contempt.

J. T. J.

East Carelia and Kola Lapmark. Described by Finnish scientists and philologists. Edited by Th. Homén. Illustrations and Maps. (Longmans, Green & Co., 21*s.*)

The original of this work appeared in Finnish in 1918, and the present volume is a translation of the later Swedish edition. It comprises chapters on all aspects of the geography, history, and social conditions of that part of Arctic Russia which lies south of the Arctic Ocean, between the White Sea and the frontier of Finland. The population in that region, especially in the Kola peninsula or Kola Lapmark, is far from dense, and does not enjoy a high degree of prosperity, due largely to conditions beyond the control of man. The Carelians, who have given their name to the southern and more low-lying part of this region, are a branch of the Finnish race, and are found also in Eastern Finland. Their language is closely related to Finnish. In Carelia they form the majority of the inhabitants, except along the coast and in the White Sea ports, where Russians preponderate. But in Kola Lapmark they are in a distinct minority, except, perhaps, in

[1] See *Records of Shelley, Byron and the Author.* Pp. 112-113. (George Routledge & Sons, Ltd.)

[2] See *The Autobiography of Leigh Hunt.* Vol. II. (Constable & Co., Ltd.)

that part ceded to Finland by the Treaty of Dorpat, 1920. A movement for autonomy in Carelia followed the Russian Soviet revolution and, fanned by Finnish sympathy, now takes the form of a demand for union with Finland. The main arguments against this wish, apart from the opposition of the Russian Soviet, are, first, that the minority of Finns and Carelians in the Kola peninsula would not justify its inclusion in any cession of territory, and the result, if Carelia were ceded, would be a detached portion of Russian territory; and, secondly, that the loss of Carelia would cut the important Murman railway which affords Russia access to an ice-free port on the Arctic coast. The volume is a genuine contribution to knowledge, and the authors leave facts to speak for themselves, laying little stress on the propagandist side of their task. R. N. R. B.

THE EVOLUTION OF THE EARTH

Earth Evolution and its Facial Expression. By WILLIAM HERBERT HOBBS. (Macmillan & Co., Ltd., 15*s.*)

This book embodies the views of the author, a professor in the University of Michigan, on the evolution of the earth and its facial expression; it is a vigorous exposition that will interest not only the geologist, to whom it is primarily addressed, but also the general reader who is interested in this subject. Professor Hobbs gives a clear and useful summary of the evidence that has accumulated against the now almost abandoned nebular hypothesis of the origin of the world, and points out how foolish people were ever to have believed in it. He is against any theory which describes the interior of the earth as molten; he disbelieves, as do many others, in the relative permanence of the great oceans, and dismisses summarily the idea that the presence of radio-active substances compensates to any degree for the loss of heat from the earth by radiation into space.

He believes that the earth is in process of shrinking from the form of a sphere (in which the ratio of volume to enclosing surface is a maximum) to that of a regular tetrahedron, in which this ratio is a minimum, and the most valuable part of the book contains an exposition of this hypothesis. The author believes also that the age of the earth has been quite unnecessarily exaggerated; he thinks that twenty-four million years is sufficient to account for all known geological phenomena.

The general reader cannot but admire the freshness of outlook and the originality of some of Professor Hobbs' ideas, even when possibly he is riding off at a tangent. He is against conventionality of thought on geological subjects, or bowing the knee to the opinions of great men. As an example:

"Anyone who has examined into the history of the theories of earth evolution must have been astounded to observe the manner in which the unique and the difficultly explainable has been made to take the place of the common and the natural in deriving the framework of these theories. The part of the accidental and fortuitous has been by no means a small one in guiding the thoughts and the speculations of those who have dealt with the fundamental theories of the universe.

"The unique rings of Saturn gave shape to the nebular hypothesis. The almost unique properties of water near its temperature of congelation was largely responsible for the idea of a molten earth core, long the orthodox doctrine of geological science. The unique rigid mass of Bohemia near the arcs of Europe and that of India near those of Asia largely determined the form of the Suess conception of arcuate mountains. . . . Those theories which have come to receive general support . . . have quite generally owed their success to the unusual prestige of their promulgators by reason of some outstanding piece of investigation, though this may have been in a different field from that of the theory that has been added to the body of orthodox doctrine. This was notably true of Laplace and his great work, the *Méchanique Céleste*, in which the famous nebular hypothesis is contained as an apparently little considered afterthought appearing as an appendix. . . . Once accepted by the leaders of thought, the position of a new theory is one peculiarly immune from attack. If its rise to prominence is in any way sensational, the theory becomes, as it were, in a measure canonised and clothed with a quality of sanctity. Attacks upon it are welcomed as little by the scientific profession as they are by the promulgators of the theory. The Einstein theory of relativity, which is just now in the saddle, receives extravagant praise, and the voices of those who point out its fallacies are lost in the thunder of applause."

But at times Professor Hobbs is much less illuminating and convincing. He is greatly enamoured of the idea that the span of geological time has been greatly overestimated, and this, he believes, is largely due to "the accident of location of those who have studied geological processes. Had the early universities been located within the Pacific area (where earthquakes are frequent) rather than about the Atlantic; had geologists made their investigations within those belts of the earth which are undergoing rapid change—the orthodox view concerning the time which has been necessary for the accomplishment of the past geological changes would have been found to be a fraction only of that which it is now supposed to be."

But what about the opposing evidence, that of the physicists, which demands an age for the earth forty times greater than Professor Hobbs' estimate? He does not discuss it, and in the only place where he mentions it, he writes as though he did not properly understand it. It is well to show how bees in men's bonnets and the accidents of environment have twisted grotesquely the truth that men have sought in the past, but views on geological or any other problems cannot be generally accepted if their author so patently neglects the conclusions of men now living. A. S. R.

BOOKS ON PSYCHOLOGY

The Care of the Adolescent Girl. By PHYLLIS BLANCHARD, Ph.D. (Kegan Paul, Trench, Trübner & Co., Ltd., 7*s.* 6*d.*)

The title of Dr. Blanchard's book does not give quite a fair idea of its scope, for it is not an elementary handbook of useful advice, but a study of the psychology of

the adolescent girl in particular, and a general review of the development of the sexual impulse as a preoccupying influence in the life of man, looking forward finally to a time when it shall become less fulminatingly masculine and, approaching the feminine ideal, shall irradiate a new and less competitive civilisation.

In the *crise d'adolescence* of the girl the author sees a conflict between the racial instincts on the one hand, urging her towards the goal of womanhood and the self-abnegation and sacrifice that it exacts, and, on the other, the egocentric impulse that demands a free expression for her personality; a conflict often biased by what Freud regards as the *causa causans* of it, the difficulty of breaking free from the infantile attachment to one of the parents. This seems a very reasonable view so far as it goes, but adolescence is a difficult time for boys as well as for girls, and one is inclined to look for an underlying factor common to both sexes. Jung and especially Nicoll have pointed out that at adolescence, as at other periods of transition, there is frequently a reluctance to adopt the new attitude towards life, to leave the old and known and to accept what is virtually a new personality. This seems to spring from a deep source of inhibition and to merit rather more consideration than the author has given it.

For the difficulties of a woman's life the author lays much blame upon man, who has exploited her innate tendency to renunciation and, when she endeavours to escape, has infected her with his ideals of power and domination. These arrows of criticism have been aimed at man, usually with more venom and less precision, tolerably frequently of late years, and this is no place to make an apologia for him, yet it may be ventured that the great wave of introversion that is affecting the psychology of the Western nations, and is possibly less marked on the other side of the Atlantic, is beginning to modify the "will to power" masculine type that Dr. Blanchard describes, and tending to diminish a little the mutual antagonism of the sexes.

One chapter is devoted to the practical question of education and the means of sublimating the primitive energy liberated at puberty, and at the same time providing a channel of self-expression, in literature, art, and social activity, and by more humanistic methods of teaching.

Dr. Blanchard writes a firm, clear prose, and her book should appeal to the general reader as well as to the specialist in education. F. A. H.

Morbid Fears and Compulsions. By PROFESSOR H. W. FRINK, M.D. (Kegan Paul, Trench, Trübner & Co., Ltd., 21s.)

Dr. Frink tells us in a foreword that the present volume is intended as a general introduction to a second one in which morbid fears and the compulsion neurosis will be discussed from a therapeutic and more technical standpoint. The title of the book does not, therefore, give a very fair idea of its scope, since more than half of it is devoted to an exposition of the doctrines of the Freudian school of psychology.

Dr. Frink writes primarily for the physician, and therefore tends to present psycho-analysis rather in its application to morbid psychology than as a method of investigating the human mind or as a system of philosophy; but the reader will find in the first part of the book what might be called a good working guide to the Freudian psychology; the more academic features are omitted and some of the later developments are not dealt with, but many misconceptions are cleared away and the author does good service in explaining what is *not* meant by the "Œdipus complex" and other much abused and misunderstood terms.

It is perhaps unfortunate that certain theories which are by no means self-evident are stated almost axiomatically, as when the author says that "the masochistic partial impulse furnishes the motive for obedience," and, a little later, "the primitive sexual curiosity thus becomes a desire for general knowledge," these instances are the more important since the principle to which they refer, namely, the evolution of the higher social instincts from the sexual impulse, is one of the points of Freud's teaching that has been most strongly criticised, and to present such a theory axiomatically is to give the impression, which reference to the original sources would show to be incorrect, that it is not supported by evidence. Such a method of presentation has the advantage of simplicity and seems to be common among the expositors of psycho-analysis, but it obscures the fact that Freud constructed his theories, tentatively for the most part, upon an accumulation of evidence, and it gives the impression that they have assumed a greater fixity and rigidity in the minds of his followers than is perhaps altogether warranted in view of the existence of alternative theories and explanations.

The later part of the book is of great value from the point of view of practical therapeutics, for it gives what is seldom possible in a textbook—a detailed analysis of two cases. The first case is especially useful, for in it the author demonstrates the important part played by non-sexual factors in the causation of a neurosis—factors that are admitted by the Freudian school to have their importance, but, as Dr. Putnam hints in a sympathetic but critical preface, are sometimes apt to escape recognition. F. A. H.

The Technique of Psycho-analysis. By DAVID FORSYTHE, M.D., D.Sc., F.R.C.P. (Kegan Paul, Trench, Trübner & Co., Ltd., 5s.)

The term "psycho-analysis" applies by right of priority to the methods employed by the Freudian school of psychology for investigating the mental processes and, if strictly used, it does not cover the theory and practice of those other schools of psychology that have developed out of the original teachings of Professor Freud. Dr. Forsythe's book is therefore, as its title implies, a description of the methods to be employed in putting the teachings of the Freudian school into practice.

It is written for those of the medical profession who are practising, or thinking of practising, psycho-analysis, and the latter are warned that they will find it neither easy nor lucrative. It naturally presupposes that the reader is already acquainted with the theoretical aspect of the subject.

Dr. Forsythe's long experience enables him to give valuable advice about the pitfalls and difficulties that may be encountered, but he does not exclude small practical details such as the arrangement of the consulting and waiting rooms and the hours of treatment.

For a small book it contains rather a large number of misprints, but these will doubtless be corrected in a later edition. F. A. H.

SHORTER NOTICES

Radiations from Slow Radium and Their Therapeutic Value. By JOHN B. KRAMER. (Baillière, Tindall & Cox, 12*s.* 6*d.*)

A nicely produced but pretentious book, containing several very inaccurate descriptions of simple scientific facts. Mr. Kramer's case is that impure (and therefore weak) radio-active preparations (for which he has invented the name Slow Radium) have a therapeutic value similar to that of pure radium, if applied in proper amount and for the proper time. This he supports with many facts, illustrations, and descriptions of cures. But since radium is radium, whether pure and strong or impure and "slow," this case needs no arguing; it is admitted; indeed, it is self-evident. If Mr. Kramer really understood radio-activity, he would not only have escaped falling nto several egregious errors relating to it; he would not have written this book.

Patents and Chemical Research. By H. E. POTTS, B.Sc. (Liverpool University Press, 8*s.* 6*d.*)

This subject is intimately described by one who is both a chemist and a patent-agent, and the book is primarily addressed to research chemists who have an interest in the commercial exploitation of their work. It is a plea for the closest co-operation between chemist and patent-agent. In making out his case, Mr. Potts has succeeded in writing an exceedingly interesting book, which all chemistry students attracted by the subject-matter of the title would do well to read; it is really an interesting talk about the whole subject, with apt illustrations, and without unnecessary technical or legal jargon.

Rays of Positive Electricity; and Their Application to Chemical Analysis. 2nd Edition. By SIR J. J. THOMSON, O.M., F.R.S. (Longmans, Green & Co. 16*s.*)

The Emission of Electricity from Hot Bodies. 2nd Edition. By O. W. RICHARDSON, D.Sc., F.R.S. (Longmans, Green & Co., 16*s.*)

These books, new editions in the series of Monographs on Physics edited by Sir Joseph Thomson and Dr. Frank Horton, give clear and up-to-date accounts of subjects which the authors themselves have been first in developing They are, of course, for advanced students only.

Sir Joseph Thomson's book includes an account and a discussion of Dr. Aston's recent work. The plates in the appendix are excellent, but the figures in the text have suffered from the quality of the paper on which they have been reproduced. The book, although on a highly specialised subject, has the merit of being exceedingly readable; the treatment and the style are a model for a scientific monograph.

Books Received

(Mention in this column does not preclude a review.)

The Temple Coins of Olympia. By CHARLES T. SELTMAN. With a Foreword by SIR WILLIAM RIDGEWAY. Illustrated. (Cambridge: Bowes and Bowes.)

A Short History of the International Language Movement. By PROFESSOR A. L. GUÉRARD. (T. Fisher Unwin, Ltd., 21*s.*)

Man, the Animal. By PROFESSOR W. M. SMALLWOOD, Ph.D. Illustrated. (The Macmillan Co., 12*s.*)

Plane Geometry. By L. B. BENNY, M.A., F.R.A.S. (Blackie & Son, Ltd., 10*s.* 6*d.*)

Atmospheric Pollution. Report by the Advisory Committeee on observations in the year ending March 31, 1921. (Published for the Meteorological Office, Air Ministry, by H.M. Stationery Office, 2*s.*)

Le Leggi delle Soluzione diluite ed Elettrolitiche secondo il metodo sperimentale. By ING. PROFESSORE GAETANO IVALDI. (Milano: Stab. Tip. Lit. Stuechi, Ceretti E.C.)

Earth Evolution and its Facial Expression. By WILLIAM HERBERT HOBBS. (Macmillan & Co., Ltd., 15*s.*)

See review in this issue.

Mathematics for Students of Agriculture. By SAMUEL EUGENE RASOR. (Macmillan & Co., Ltd., 7*s.* 6*d.*)

A year's course of work in mathematics for students taking agricultural courses in vocational and technical schools and colleges, by the professor of mathematics in the Ohio State University.

Notes and Examples on the Theory of Heat and Heat Engines. By JOHN CASE, M.A. (Heffer, 7*s.* 6*d.*)

A very useful *cram* book with many good examples worked and unworked.

A Concise History of Chemistry. By T. P. HILDITCH, D.Sc., F.I.C. Second Edition. (Methuen & Co., Ltd., 6*s.*)

Students of chemistry will find this a useful book. It is excellent in plan, trustworthy, astonishingly comprehensive, easily consulted, and it is readable. The call for a new edition has enabled the author to bring the record up to date. Of course everything is not said, but how could it be in 225 pages? It is all "business"; no human touches, not a single little personal anecdote, no pictures. A few slips have been carried over from the first edition. Radium, for example, is described as having been isolated in 1902 instead of in 1898.

Organic Chemistry, or Chemistry of the Carbon Compounds. By VICTOR VON RICHTER. Vol. II. *Chemistry of the Carbocyclic Compounds.* Translated from the Eleventh German Edition by E. E. FOURNIER D'ALBE, D.Sc. (Kegan Paul, 35*s.*)

A reference book that has stood the test of time, crowded with facts which are admirably arranged and well indexed. In its English dress it has two obvious defects: it is translated from a book ten years old, and the translation is

poor. Many technical terms are not given their English equivalents, but names which are literal translations of the German ; and some of the English is not English.

Inorganic Chemistry. By T. Martin Lowry, C.B.E., D.Sc., F.R.S. (Macmillan & Co., Ltd., 28*s*.)

Correspondence

JUPITER'S SATELLITES

To the Editor of Discovery

Sir,

I have read with much interest the article by the Rev. Hector Macpherson on " The Giant Planets," in the March issue of Discovery.

Considering the suggestion made in the article referred to that the smaller satellites of Jupiter may be " captured " asteroids, in contradistinction from the origination of the larger satellites, which may be considered to have been formed out of the original Jovian mass, in like manner as the earth-moon satellite was doubtless formed, would not the " captured " asteroids have greatly elongated orbits, compared with the orbits of the larger satellites of Jupiter ?

Yours, etc.,
Legh Osborn.

23 Queen Street, Darlington.
March 2, 1922.

To the Editor of Discovery

Sir,

In reply to Mr. Osborn's letter, the suggestion has been made from time to time that the smaller Jovian satellites and the satellites of Mars were originally asteroids which at some epoch in the remote past came into the spheres of influence of these planets. But, of course, the suggestion is merely a suggestion. At the same time, the similarity in size between these tiny moons and the asteroids seems to call for some such explanation.

As to the question raised by Mr. Osborn regarding the shape of the orbits of these satellites, Professor T. J. J. See's " capture theory " may be helpful. He believes that all satellites " formerly moved about the sun, and since they were captured have had their orbits reduced in size and rounded up under the secular action of the resisting medium formerly pervading our Solar System." Few astronomers would be disposed to accept this theory in its entirety. But it is not improbable that it is a satisfactory explanation of the present orbits of these minute moons.

Yours, etc.,
Hector Macpherson.

30 Pilrig Street, Edinburgh.
March 7, 1922.

RACIAL INTERMARRIAGE

To the Editor of Discovery

Sir,

When in a public library to-day, I glanced through your March correspondence column and noticed a query about the above.

If it be of any interest to your inquirer, I may say that in 1902 I was assisting another medical practitioner in a coast town of a south-east county in England, and came across a family of seven children which was the result of one of these marriages. The African parent was of a South African race, the mother was English ; and the children took completely in appearance after one or other of the parents. There was *no* child in this family which showed part European and part African. From what I saw of them, the children were healthy so far as general health was concerned ; but I understood that they were inclined to take sides in the event of a dispute between two of different appearances over some trifling matter which, unless the parents were present at the time, was liable to develop rapidly into a more serious family squabble.

Yours, etc.,
Frederick D. Welch,
M.R.C.S., L.R.C.P.

Hartley, Longfield, Kent.
March 24, 1922.

THE PROBLEM OF PERSONALITY

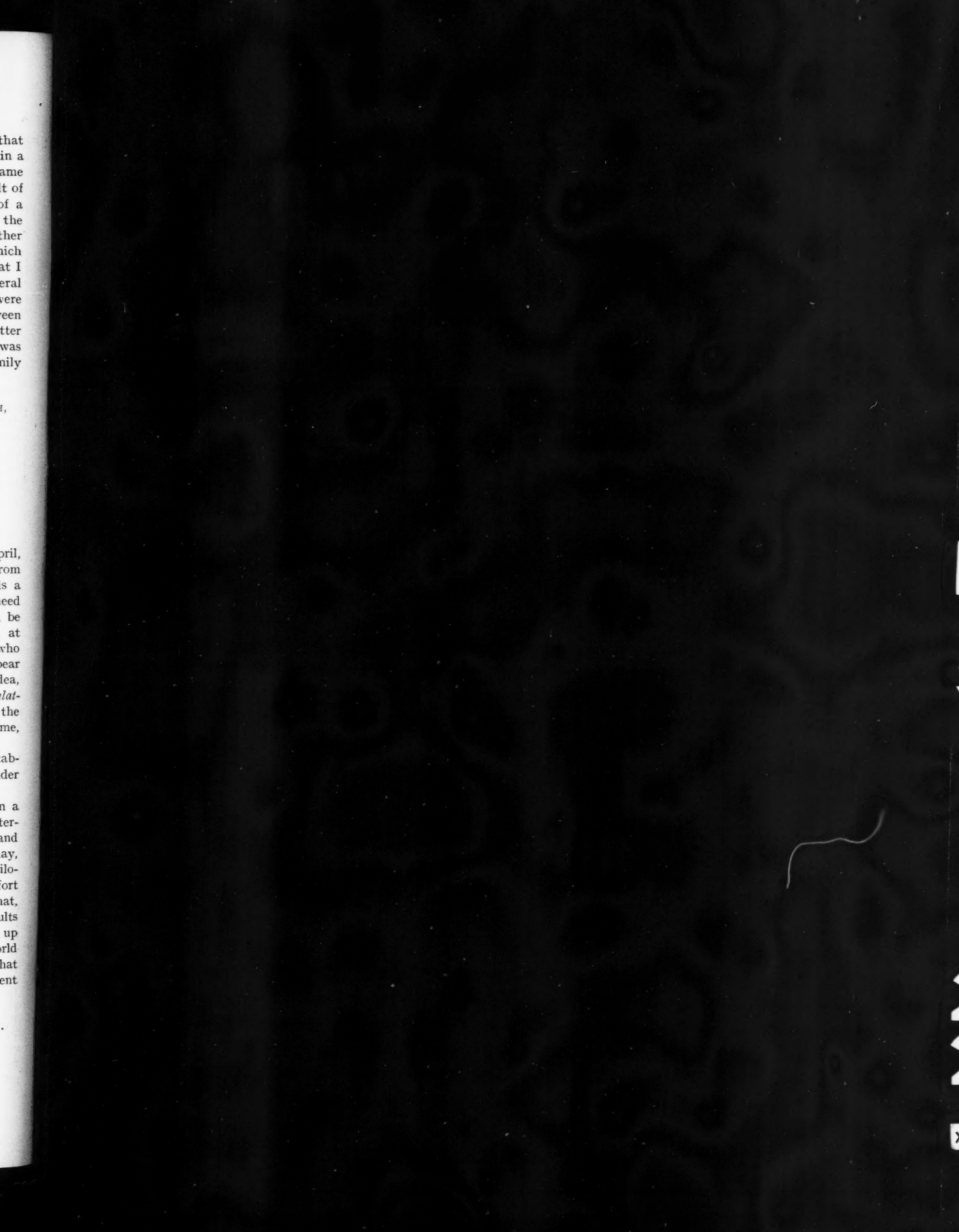
To the Editor of Discovery

Sir,

The suggestion in your Editorial Notes for April, that a Commission should be set up to collate views from all angles on the Problem of Human Personality, is a most valuable one. In the first place, it is a crying need of the times that the public should, if it be possible, be given some orientation in matters where they are at present the prey of writers and speakers, either those who combine glibness with ignorance, whose efforts appear daily in the Press, or those who suffer from a fixed idea, of whom the gentleman whose work, *The Glands Regulating Personality*, has apparently led you to make the aforesaid suggestion, would appear to be a good, if extreme, example.

Secondly, if a Commission of this sort could be established, the door would be opened for work on a far wider field—the Co-ordination of Science in general.

It is unnecessary to enlarge on what is more than a tendency of modern Science and Thought to work in watertight compartments. In matters of deep research and high achievement the process is inevitable. One may, however, venture the prophecy that Science and Philosophy will sooner or later be forced to make a great effort to obtain co-ordination of all their branches, and that, when this is achieved, not only will there be direct results of the utmost importance resulting from the linking up of different lines of research and thought, but the world will find itself possessed of an intellectual mechanism that may conceivably open the way to fields of which at present one can only dream.

Yours, etc.,
Frank W. Herbert.

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April 7, 1922.